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Meetings

California Natural Gasoline Association—October 3, Richfield Building, Los Angeles.

•

American Institute of Mining and Metallurgical Engineers, Petroleum Division—October 10, 11, and 12, Houston, Texas.

•

American Gas Association, Manufacturers' Division—October 14, 15, 16, 17, and 18, Chicago, Illinois.

•

American Association of Petroleum Geologists, Mid-Year Meeting—October 16 and 17, Mexico City, Mexico.

•

American Association of Petroleum Geologists, San Antonio Section (San Antonio Geological Society, Seventh Annual Meeting) — October 16 and 17, Mexico City, Mexico.

•

Independent Petroleum Association of America, Annual Meeting — November 4 and 5, Adolphus and Baker Hotels, Dallas, Texas.

•

American Petroleum Institute, Sixteenth Annual Meeting — November 11, 12, 13, and 14, Biltmore Hotel, Los Angeles, California.

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The Course of Oil

By K. C. SCLATER

Increasing Yield of Stripper Fields

The third annual Petroleum Conference of the Illinois-Indiana Petroleum Association was held in June of this year, the discussions being devoted chiefly to stripper well and field operations.

More than 400 million barrels of oil and enormous quantities of gas have been produced from the Southeastern Illinois oil field during the past 30 years.

Though the wells in this field are now in the stripper class, nevertheless, operators there are alive to the opportunities for increasing the ultimate recovery and also the rate of production from their properties by the application of modern secondary recovery methods. Measurements of reservoir pressure are now made by a systematic study of fluid levels in several areas, and the character and results of natural water drives observed in order to gain a better understanding of sub-surface conditions, about which, it is admitted, comparatively little is known.

Flooding of Illinois oil sands was legalized by an act of the state legislature on June 8, 1933, and within two months an artificial water-flooding project was under way. The study of natural water-floods—also termed accidental floods because of the nature of their occurrence—have aided in applying artificial water-floods, and it has been said that "the result obtained by accident should be increased by purpose."

The artificial water-flooding project has demonstrated the feasibility of the process in the area and that it is an economical method of increasing ultimate recovery. In this first experiment some 50,000 barrels of water was used to produce 7,000 barrels of oil.

These results may not seem significant when the high rates of production possible from flush fields of today are considered, but an increase in the ultimate yield from old fields by secondary recovery methods will in the aggregate mean a substantial increase in the Nation's available oil reserves.

Timely Hearing Is Called

Uniform regulations for the deep Rodessa field are in the offing—at least it is hoped they are. A hearing will be held by the Texas Railroad Commission at Marshall, September 27, "to determine whether or not special regulations and orders shall be adopted for the prevention of waste."

Besides interested operators, officials connected with the regulation of oil production in Arkansas and Louisiana are expected to be present.

The appearance of water in one new well in the Rodessa field emphasizes the desirability of having uniform regulations, and that these be based on reservoir conditions. Even though information regarding actual sub-surface conditions may at this stage be meager, frank consideration should be given to the facts that the wells are deep and that water may be an imminent hazard.

Strict regulation at this stage of development should be followed. Later, when further knowledge of sub-surface conditions is available, restrictions may be modified if necessary.

So far as well allowables are concerned, the plan for prorating wells is likely to be the one question that will be most difficult to agree upon. As in the case of drilling regulations, it will be the better part of wisdom to be guided by reservoir conditions.

Evidence Cannot Be Refuted

Apparently the quietus has been put on intentional penetration of adjoining properties by whipstocking in California. Numerous wells have been plugged by court order; others have been plugged and abandoned by owners before a survey could be made showing them guilty of trespass.

The offence of trespass applies only to wells that have been drilled recently, and not to old wells drilled before directional drilling by whipstocking became a practice. It is reported that thirty or more wells in the Long Beach field are involved and will be plugged and abandoned as a result.

A tangible record of the survey of a hole is irrefutable evidence against which the unscrupulous operator cannot defend himself in court.

Research In Metals

Low temperatures and high pressures met with in the oil industry make severe demands on equipment. The propane dewaxing process in the refining of oil, for example, requires pressure vessels and auxiliary apparatus that must function at sub-zero temperatures. Metals employed in the fabrication of equipment must be suitable for use under the extreme conditions encountered.

Low temperatures affect the properties of metals. Research reveals that the most important effect of low temperatures on the engineering properties of steel is a marked tendency to induce brittleness. To counteract this tendency, alloying with nickel, it has been found, is valuable, as it aids in postponing the inception of brittleness to lower temperatures and lessens the severity of the effect.

For pressure vessel work it has been important not only to develop a satisfactory steel but also to demonstrate persistence of the improvement in welded construction.

Increasing the application of metals through research of this kind plays a vital role in refining progress.

« « « HIGHLIGHTS IN OILDOM » » »

To Take Potential Test on All East Texas Wells

Each well in the East Texas field will be given a potential test shortly after September 19, which may necessitate the shutting down of the entire area. This announcement has been made by Chairman Ernest O. Thompson of the Texas Railroad Commission. Each well will be given a one-hour test.

The decision was reached at a meeting held by the commission after it had been disclosed that some of its potential and allowable records had been tampered with and one commission employee discharged.

Following the meeting Chairman Thompson announced:

"It has been two and one-half years or so since we took general potential tests in East Texas. It is time we took some more, particularly in the light of the discovery that our East Texas records had been tampered with. We will make one-hour potential tests of every well in the field, with details to be worked out at the September 19 proration hearing. Of course, pressures over the field will have to be equalized before the potential tests are taken."

This latter statement is taken to indicate that the taking of the tests will be preceded by the complete shutdown of all wells in the field.

At present East Texas has almost 19,000 wells, of which 4,900 are classified as marginal, hourly potential being rated at 14,119,325 barrels. Studies by various operators have indicated, however, that some, if not many, of the old potentials are greater than present capacities to produce. Some dead wells are said to be included by certain operators who run these wells' allowables from their other wells. The test of all producing wells is expected to cause a drastic revision of figures in some instances.

●

Drastic Cut in California Crude Price

Overproduction has resulted in a drastic cut in crude oil prices in California. The initiative was taken by the Standard Oil Company when on August 29 it posted a price schedule representing a maximum reduction of 50 cents to 60 cents per bbl., the greatest cut being on light crudes. The Standard's action was followed by the Union Oil Company on August 30.

At the time of making the new prices the Standard Oil Company issued the following statement:

"Since the first of June there has been an increasing tendency to break away from proration, until at the present time production is in excess of 600,000 bbl. per day, as against an estimated consumption demand, estimated by the U. S. Bureau of Mines, of less than 520,000 bbl. per day. With the passing of the season of peak demand for petroleum, the company is confronted with large additions to storage, which it is unwilling to undertake, if at all, at the present level of crude oil prices.

"A very large percentage of the producers have been working diligently since the first of June to bring about voluntary agreement of proration in an effort to keep production within consumption demand. These efforts have not been successful. When it is again demonstrated that production can be controlled to keep within consumption demand, it is to be hoped that conditions will justify a return to higher prices.

"This company holds no contracts for the purchase of crude oil which a seller who does not wish to accept these prices cannot cancel, either immediately or upon ten days' notice, according to the form of the agreement; and the company has a similar right to cancel out its day by day contracts immediately."

For some time efforts have been made to obtain a proration agreement between producers representing 95 percent of the state's production. At the time the price cut came approximately 80 percent of the producers had signed the agreement. At a meeting held September 5 it was again decided that every effort would be made to sign up the required number of producers in an attempt to restore the crude price structure of California.

●

Fitts Shows No Pressure Decline Past Month

Early this month, the average bottom-hole pressure in 24 key wells in the Fitts pool of Pontotoc County, Oklahoma, was reported to be 1556 lb. per sq. in., no decline having occurred since August 2, when the previous test was made. During that period more than 600,000 bbl. of oil were removed from the Bromide formation. During the previous period, or from July 2 to August 2, bottom-hole pressure showed a decline of 62 pounds.

●

Connally Oil Control Act Is Upheld

The constitutionality of the Connally oil act was upheld recently by Judge Randolph Bryant in Federal District Court at Sherman, Texas. The measure, enacted by Congress last February, was designed to prevent the movement in interstate commerce of oil produced or withdrawn from storage in excess of the amount permitted by state laws.

Judge Bryant's decision was rendered against the East Texas Refining Company of Dallas, which was seeking tenders on 155,000 bbl. of oil. The company named as defendant Federal Tender Board No. 1 and attempted to prove the Connally law unconstitutional.

Far-reaching importance was attached to the decision of Judge Bryant, as it was expected to have considerable influence on the movement of oil in interstate commerce, particularly from the East Texas field.

PROGRESS OF MAJOR PIPE LINE WORK

ADDITIONAL pipe line facilities for western Kansas, the need for which has been felt for some time, are to be provided. The construction of two separate lines will commence in the near future, it is announced. From Valley Center, Kansas, to a main pump station near Chase in Rice County, the Socony-Vacuum Corporation, White Eagle Division, will lay an 8-in. line, 75 miles in length. Preliminary work has been completed and construction will begin immediately, it is stated.

The other project will be an 8-in. line to run from Chase northwest approximately 45 miles to a point in Russell County, from where branch lines will lead off to most of the pools of Russell, Barton, Rice, Ellis, and Ellsworth counties. This line will be a joint project of the Empire Gas and Fuel Company, The Texas Company, and the Phillips Petroleum Company. A separate organization will be formed as a construction and operating unit for the line.

It is believed that the lines will handle approximately 10,000 bbl. daily to begin with, but facilities are to be provided for 20,000 bbl. daily to care for future expansion.

The ownership of the two projects are in no way connected, but taken together the two lines will afford a continuous and direct outlet for western Kansas crude.

●

The Panhandle Eastern Pipe Line Company will construct a 300-mile 24-in. line from Rockville, Indiana, to Detroit, Michigan, as the result of a contract entered into by that company with the Detroit City Gas Company. The latter now supplies Detroit consumers with manufactured gas, and under the terms of the contract the Panhandle Eastern will provide Texas Panhandle gas for distribution. The contract was made on a 15-year basis, beginning July 1, 1936.

Laying of the line to tie-in with its trunk system at Rockville will start around January 1, it is expected. It is estimated that the construction of the line from Rockville to Detroit will cost $9,000,000, and that the Panhandle Eastern will spend another $9,000,000 improving its facilities from Rockville to the gas fields of the Southwest.

●

Completion of the Valley Pipe Line Company's line from the Sam Fordyce field of Hidalgo County, Texas, to Port Isabel is tentatively scheduled for completion around September 20. Approximately 200 men are at work on the line and rapid progress has been made. The line is being coupled over its entire length.

Crude is being stored at the Sam Fordyce field in special storage tanks provided for that purpose until the line is ready to move it to Port Isabel. It will be possible to move approximately 6,500 bbl. of crude daily through the 5½-in. carrier and oil in storage will be used to maintain this movement since the field's allowable is but 3,200 bbl. daily.

The refinery being constructed at Port Isabel in addition to terminal facilities is expected to be completed by November 15.

Initially but one pumping unit will be installed at the Sam Fordyce field to handle the pipe line runs, but another will be added when needed.

The pipe line, refinery, and terminal facilities represent an investment of approximately $650,000. The development is being undertaken by Murchison and Closuit, Inc., of Dallas, who with G. L. Rowsey and Harris Melaskey of Taylor, Texas, own controlling interest in the three valley companies.

●

Approximately 200 miles of gas pipe lines may be laid in South Texas if several deals now pending are consummated. Construction of the lines are said to depend upon the success of interested parties in contracting for 75,000,000 to 100,000,000 cu. ft. of gas per day.

The largest project involves the laying of a line from the Pettus district, Live Oak and Bee counties, to Austin, Texas. The line likely would run to Austin via San Antonio, totaling 150 miles. The gas would be used for industrial and domestic purposes, and the deal would be financed by a PWA loan and grant.

The second project would be financed by an eastern concern, it is understood. Representatives are in South Texas attempting to close contracts for the purchase of sufficient gas to supply the line, which would require approximately 30,000,000 cu. ft. daily.

The names of those concerned in these two projects have not been made public.

Recently the Southwest Gas Company announced plans for construction of a line from the Fordtron field, north Victoria County, to the Yoakum area, a distance of 20 miles.

●

Work on the Lone Star Gas Company's 110-mile 20-in. pipe line from the Cayuga and Long Lake gas areas of Anderson County, Texas, to Irving in Dallas County, is progressing rapidly and it is scheduled to be completed by November 1. For the most part the contractors, the Oklahoma Contracting Company, and Ford, Bacon and Davis, Inc., have been favored with dry weather, greatly assisting them in the speed of laying the line, which is being welded and coupled. Most of it is being laid through soft soil except for about eight miles near Irving where there is considerable hard rock that will have to be blasted.

●

Construction of the North Central Gas Company's line from Clayton, Wyoming, to Lewellen, Nebraska, has started, and it is expected that the 217-mile carrier will be ready for operation by January 1. A portion of the pipe laid will be new, the remainder reconditioned stock. The order for the new pipe has been placed, and Williams Brothers, Inc., of Tulsa are busy reconditioning old pipe and stringing it along the right-of-way.

●

Contracts for right-of-way for 200 miles of gas gathering lines in the west part of the Joiner area in the East Texas field are being procured by the Sinclair Refining Company. The company plans to construct a natural gasoline plant in Smith County near Wright City, and the gathering line would connect virtually all the Sinclair Prairie leases in Smith and Rusk counties with the plant.

LATEST ACTIVITIES IN THE OIL FIELDS

WITH the bringing in of the second and third wells in the Rodessa field of Louisiana operators are of the opinion that the area will prove extensive in oil production. The Haynes Production Company completed its No. 1 Lawton at 6052 ft. for an estimated daily production of 30,000 to 50,000 barrels. At the latest report the well was being allowed to flow at the rate of 525 bbl. per hour through 2-in. choke. No open-flow gauge had been taken. Pressure on the casing registered 350 lb., and on the tubing 493 pounds.

The same company also brought in its No. 1 Otwell at a total depth of 6081. It appeared to be the field's largest producer, but after flowing 7064 bbl. was making 4½ to 10 per cent salt water, and the owners were preparing to plug back and shut off the water, thought to be coming from the bottom of the hole.

●

R. O. Bailey, James A. Brouk, and S. E. Bailey may have opened a new pool in Kansas with their No. 1 Galliart near Dubuque in southeastern Russell County. The well was drilled to a total depth of 3278 ft. in the Arbuckle lime and had 3000 ft. of oil in the hole. Later 5-in. casing was run and tankage provided. Nearest production is the Beaver pool to the south in Barton County.

●

The Republic Petroleum Company's No. 1, 15 miles southwest of Los Angeles, has been officially given credit for discovering a new deep-producing field in the Los Angeles Basin. The well is drilled to a total depth of 7405 ft., and after swabbing failed to produce a steady flow, was placed on the pump, making approximately 400 bbl. per day of 24.5 gravity oil, cutting 14 percent fresh water.

The new discovery is four miles from the Venice field and the gravity of the oil four to six degrees higher. It is not believed that the two areas are in any way connected.

●

The finding of two new oil pools in Duval County has brought to 20 the number of new fields opened in South Texas so far this year. The Magnolia Petroleum Company has completed its No. 1 Duval County Ranch Company one and a half miles northwest of the outpost production of the Government Wells field. Drilled to a total depth of 2149 ft., the well made an initial flow of 13 bbl. per hour through ⅜-in. choke. Production is from the Government Wells sand.

The other new producer was in the Labbe field, northeast Duval County. This area was opened as a gas field earlier in the year. The Stanolind Oil and Gas Company, with its No. 1 Ira G. Yates, has now found oil at 2465 feet. Initially the well flowed by heads, making 72 bbl. of fluid the first 12 hours, 42 bbl. of which was oil. Later it flowed steadily through ¼-in. choke.

●

The shallower pay of the Britton sector of Oklahoma has yielded a large producer. The Slick-Urschel Oil Company and the Sinclair Prairie Oil Company brought in a big well with their No. 1 Meeker, northwest of the Britton townsite. In the Simpson formation at 6554 to 6765 ft., it was completed under pressure and initially made 2223 bbl. of oil in 12 hours. The new producer is a southeast offset of the discovery well.

●

With their No. 1 W. H. Smith test completed as a large producer, the Amerada Petroleum Corporation and the Rycade Oil Corporation have made a discovery that proves an entirely new type of production for South Texas and subsequent drilling activity may show it to be the most important strike in the history of that area, according to operators.

The well, approximately eight miles southwest of Pearsall, Texas, and 80 miles southwest of San Antonio, was drilled to 5920-27 ft. in the Buda limestone. After cleaning itself out, it produced 735 bbl. in 24 hours through 22/64-in. choke, and later 815 bbl. through 22/64-in. and 34/64-in. chokes. The oil tests 41 gravity at 82 degrees and is a light yellowish green.

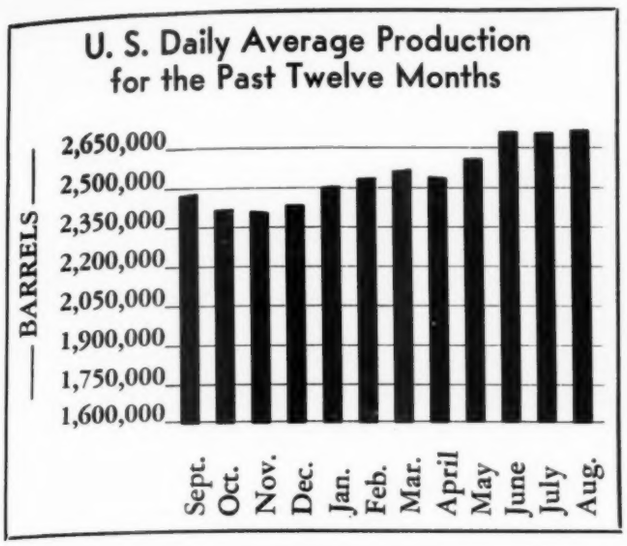
AVERAGE CRUDE PRICES

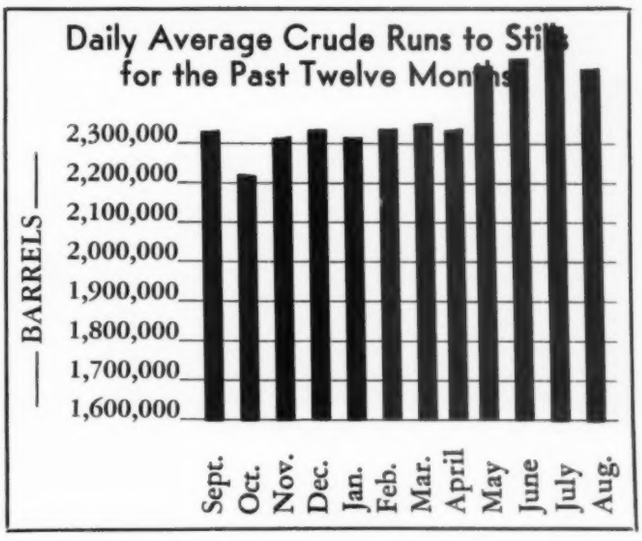
California		Louisiana	
Playa Del Rey	$ .48	North Louisiana	$ .95
Coalinga	.54	Gulf Coast	1.04
Signal Hill	.55	Illinois	1.13
Montana	1.35	Kentucky	1.13
Wyoming	1.00	Indiana	1.12
Colorado	1.00	Ohio	
New Mexico	.75	Lima	1.30
Texas		Michigan	1.02
North Central	.95	Pennsylvania	
Panhandle	.51-.71	Bradford	1.95
West Texas	.70-75	Southwest	1.67
Gulf Coast	1.04	Eureka	1.62
Darst Creek	.87	Buckeye	1.52
East Texas	1.00	Corning	1.32
Kansas	1.00	West Virginia	1.67
Oklahoma	1.00	Canada	2.10-2.17
Arkansas	.70		

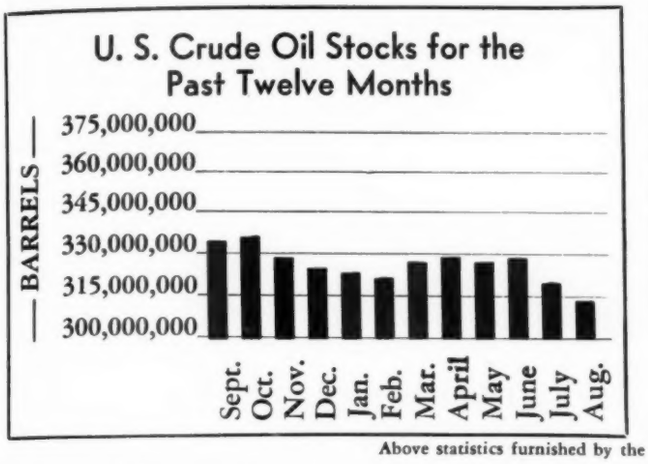
DAILY AVERAGE CRUDE PRODUCTION
Furnished by A.P.I.

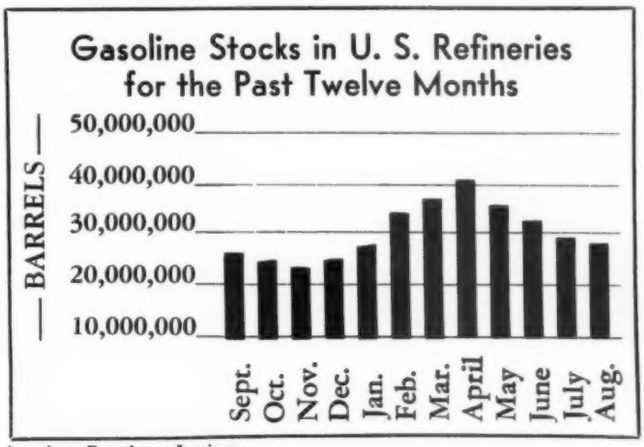
(Figures in Barrels)

	Dept. of Interior Calculations (August)	Week Ended Aug. 31, 1935	Week Ended July 27, 1935	Week Ended Sept. 1, 1934
Oklahoma	512,000	471,700	523,950	460,550
Kansas	148,000	139,750	153,050	128,000
Panhandle Texas	.....	51,950	61,800	59,800
North Texas	.....	57,600	59,050	60,950
West Central Texas	.....	25,800	25,650	27,100
West Texas	.....	150,000	156,750	154,850
East Central Texas	.....	47,850	50,450	51,800
East Texas	.....	439,250	465,000	414,850
Conroe	.....	39,350	42,200	47,650
Southwest Texas	.....	58,600	57,500	57,400
Coastal Texas (Not incl. Conroe)	.....	148,300	146,600	130,000
TOTAL TEXAS	1,024,000	1,018,700	1,065,000	1,004,400
North Louisiana	.....	24,550	22,650	24,500
Coastal Louisiana	.....	120,900	113,900	73,700
TOTAL LOUISIANA	130,000	145,450	136,550	98,200
Arkansas	30,700	30,300	30,450	31,450
Eastern (Not incl. Michigan)	103,700	102,600	105,400	108,200
Michigan	36,800	48,050	45,000	30,600
Wyoming	36,700	38,050	42,400	38,450
Montana	11,300	13,200	11,150	10,350
Colorado	4,000	4,400	4,100	3,700
TOTAL RK. MT. ST.	52,000	55,650	57,650	52,500
New Mexico	53,000	57,200	54,000	47,850
California	510,000	595,700	563,600	460,400
TOTAL U. S.	2,600,600	2,665,100	2,734,650	2,422,150









Above statistics furnished by the American Petroleum Institute.

Summarized Operations in Active Fields for August, 1935

Fields	Completions	Producers	Rigs	Drilling Wells	Depth of Production	No. Casing Strings	Gravity of Oil	Type of Tool Used
Texas								
East Texas	312	292	109	194	3600	2	40	Rotary
Duval County	28	23	1	6	2300	2	22	Rotary
Archer County	65	29	13	37	660–1800	1 or 2	40	Rot.-Cab.
Conroe	7	6	1	4	2000–7400	3 or 4	40	Rotary
Panhandle	79	76	31	135	2200–3900	2	40	Rotary
Refugio County	7	6	1	4	5200	2	38	Rotary
Oklahoma								
Oklahoma City	10	10	9	42	6500	3	39	Rotary
Pontotoc County	24	19	11	63	1800–4488	2 or 3	38	Rotary
Osage County	27	23	13	63	380–2850	2	37.5–40	Rot.-Cab.
Kansas								
McPherson County	12	10	3	22	2900–4300	2	38	Rot.-Cab.
Harvey County	3	1	2	21	3450	2 or 4	37	Rot.-Cab.
Ellsworth Arch	52	39	18	109	3300	4	37	Rot.-Cab.
California								
Kettleman Hills	1	1	3	25	8300	3 or 4	40	Rotary
Long Beach	20	20	7	66	7000	3	36	Rotary

Field Activities by States for August, 1935

State	Completions		Producers		Locations		Rigs		Drilling Wells		Production, 1934 (In Barrels)
	August	July	August	July	August	July	August	July	August	July	
Arkansas	7	4	2	1	9	9	11	10	30	31	11,412,100
California	82	82	75	72	90	102	82	80	278	272	175,678,362
Colorado	2	....	1	....	....	....	5	4	23	27	1,168,000
Illinois	....	2	....	0	....	....	16	18	10	8	4,466,000
Indiana	29	7	16	3	....	....	2	3	38	33	813,000
Kansas	109	107	82	65	135	77	39	30	244	210	45,577,050
Kentucky	19	19	14	16	....	....	3	4	19	26	4,863,000
Louisiana	62	67	36	45	67	85	70	54	152	146	32,572,900
Michigan	60	38	39	25	55	40	98	115	158	139	10,589,600
Mississippi	1	1	0	0	....	....	2	2	10	11	Gas Prod.
Montana	21	14	17	13	....	....	12	19	60	57	3,797,000
New Mexico	21	19	19	14	....	....	23	14	97	96	16,529,050
New York	....	....	....	....	....	....	1	1	5	3	3,880,700
Ohio	108	151	84	97	....	....	30	39	74	144	4,291,000
Oklahoma	173	190	122	119	180	215	79	77	513	501	176,506,550
Pennsylvania	6	4	4	3	....	....	36	28	117	143	15,353,850
Texas	1085	990	810	775	1015	1133	295	513	1103	1070	380,848,000
West Virginia	35	31	28	22	....	....	28	33	76	83	4,043,550
Wyoming	10	6	9	4	....	....	12	15	78	71	12,371,100
Total	1830	1731	1358	1275	1551	1661	844	1085	3085	3079	903,350,812

THE MONTH'S ACTIVITIES IN REFINING

Per Cent Refinery Capacity Operated

Eastern Division, 77.3 percent **Central Division, 69.6 percent** **Western Division, 75.6 percent**

FRANK PHILLIPS, president of the Phillips Petroleum Company, announces that his company has organized a new corporation, known as The Polymerization Process Corporation, through which patent licenses will be available to the petroleum and natural gas industries for the practice of the polymerization process for making premium grade gasoline from refinery and natural gases.

Through exchange of patents, The Texas Corporation, Standard Oil Company (Indiana), and Standard Oil Company (New Jersey) have an interest in the new corporation and will use the new process.

The M. W. Kellogg Company has been appointed licensing agent and is prepared to make estimates and bids on complete plants for carrying out the polymerization process.

Phillips Petroleum Company for many years has been a large producer of natural gas and liquefied products derived from it, such as natural gas, gasoline, and liquefied gas, but the new polymerization process is radically different in that a chemical change takes place instead of merely a physical separation.

The Phillips Petroleum Company developed and has been operating the new process on a full commercial scale. Complete operating data will be available to the licensing agent of the new company.

T. B. Hudson, of the Phillips Petroleum Company, is president of the new corporation.

●

Refining properties of the Crystal Oil Company of Shreveport, in Cedar Grove, Louisiana, have been purchased by the Rodessa Oil and Refining Company, a new concern organized by Martin J. Grogan, president of the Grogan Oil Company, and associates. New equipment will be installed in the plant, which has been shut down for five years. When remodeled it will be capable of handling 5000 bbl. of crude daily. Some of the units will be in operation within a few weeks. North Louisiana and East Texas crude will be processed.

●

Roy J. Miller, of Roy J. Miller Petroleum Engineers, Chicago, Illinois, announces that his company has started construction of a 1200-bbl. complete distillation unit for the Sweet Oil Refining Company, Wyman, Michigan.

●

A charter has been granted to the Russell Refining Company for the construction of a refinery west of Russell, Kansas. Initially the plant will have a capacity of 2000 bbl. daily, this possibly to be increased later. It is expected to be in operation by the latter part of September.

Directors of the company are Robert Sohlberg, Sr., R. C. Russell, Charles Lichesky, Max H. Farmer, and W. F. Mitchell. Mr. Mitchell will be superintendent of the plant, and Mr. Sohlberg manager of sales.

●

At its Port Arthur, Texas, refinery The Texas Company is installing a solvent refining unit and a solvent dewaxing unit. The former will have a capacity of 2500 bbl. daily, and the latter a capacity of 2000 barrels. Both are expected to be completed and in operation by the end of the year.

●

A new cracking plant with a capacity of 700 bbl. daily is to be constructed by the Ralph M. Parsons Company for the Malco Refineries, Inc., at Artesia, New Mexico. The new unit will convert approximately 57½ percent of its in-put to high octane gasoline and leave a liquid residue that will be purchased by the Santa Fe Railway. Construction of this unit will take six months at an estimated cost of $150,000.

Malco Refineries, Inc., market their gasoline throughout the southwest under the trade name MALCO and sell fuel oil to Santa Fe. They have a 2000-bbl. skimming unit built by the Southwestern Engineering Company of Los Angeles and installed in 1931.

●

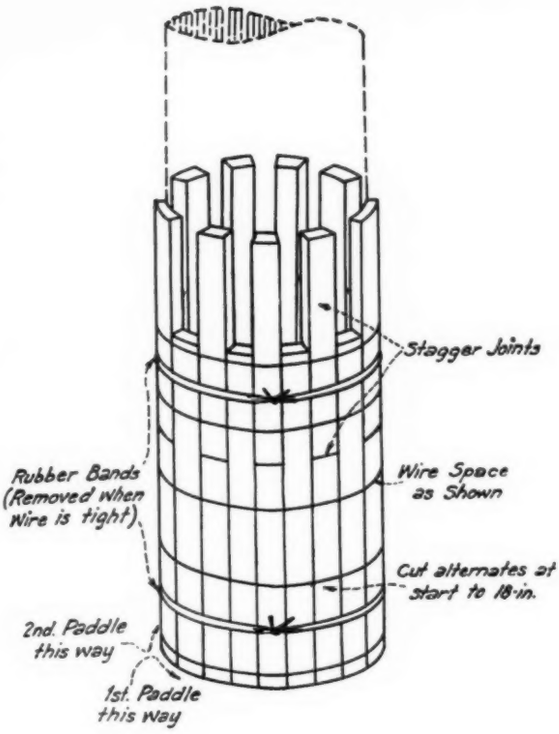
Restoration of the Canfield Oil plant at Coraopolis, Pennsylvania, destroyed by fire on June 9th, has been completed, The Austin Company, engineers and builders, announce. The project required erection of ten filter tanks, and one earth bin in a three-story, 41 ft. x 63 ft. filter house of welded steel construction and brick exterior.

Crude Runs to Stills, Gasoline and Gas and Fuel Oil Stocks, Week Ending August 31, 1935

A. P. I. Figures

(Figures in Barrels of 42 Gallons Each)

DISTRICT	Per Cent Potential Capacity Reporting	Daily Avg. Crude Runs to Stills	Per Cent Operated of Total Capacity Reporting	Total Motor Fuel Stocks Thousands of Bbl.	Gas and Fuel Oil Stocks Thousands of Bbl.
East Coast	100.0	493,000	80.6	13,958	13,260
Appalachian	94.8	97,000	66.4	2,017	921
Ind., Ill., Ky.	95.9	360,000	84.9	8,232	5,094
Okla., Kans., Mo.	84.8	278,000	72.4	4,383	4,929
Inland Texas	48.5	102,000	63.8	1,049	1,736
Texas Gulf	96.4	525,000	88.2	4,267	11,594
La. Gulf	96.4	113,000	69.3	926	4,112
No. La.-Ark.	90.0	39,000	54.2	279	430
Rocky Mountain	61.9	52,000	86.7	603	791
California	92.6	509,000	64.5	8,073	63,513
TOTALS WEEK:					
Aug. 31, 1935	89.5	2,568,000	75.4	43,787	106,380
Aug. 24, 1935	89.5	2,562,000	75.2	44,751	106,530


Stagger Joints
Rubber Bands (Removed when Wire is tight)
Wire Space as Shown
Cut alternates at start to 18-in.
2nd. Paddle this way
1st. Paddle this way

Section of blocking before paddling.

Insulating Tanks and Stills

By
M. C. COCKSHOTT

FOR a plant with the average maintenance crew the replacing of the insulation on small tanks, stills, and other circular vessels can be very efficiently handled without going to the insulation contractor.

For example, let us assume that a circular shell eight ft. in diameter and 60 ft. high has to be covered. Having selected the material suitable, usually 85 percent magnesia, the first thing is a suitable scaffold. This can be built of 4-in. x 4-in. posts with 2-in. x 6-in. girts securely nailed to these posts, bracing can be of 1-in. x 6-in. as shown in sketch.

The girts should be spaced about six ft. apart, with 2-in. x 12-in. movable planks for the men to stand on. If the tank has no ladder, provision must be made for access to the platforms. A light single block and line will also be needed for drawing up material.

Two men are all that will be needed for this work, one to keep the other supplied with material, and also to help in the application of the insulating material.

It is immaterial whether a start is made at the top or bottom as several trips up and down have to be made, and the platform moved each time to the next section.

Assuming that a start is being made at the top, sufficient material is hauled to the platform some five or six ft. from the top of the shell. The magnesia will come in blocks usually six in. wide by probably 36 in. long. This can be easily cut with a saw or sharp trowel and then broken, the thickness naturally varying with the type of insulating needed. At the start alternate pieces 18 in. long for a staggered effect.

For holding the blocks in place old automobile tires are slit up into strips about two in. wide and knotted together so that they will go around the circumference of the shell.

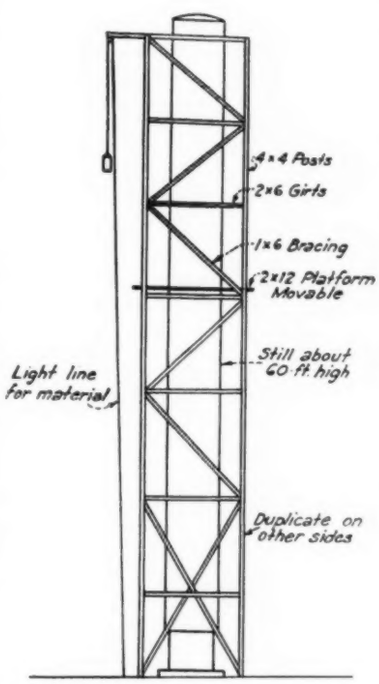
The blocks are slipped in between the rubber bands and the steel (see accompanying sketch), using two bands at top and bottom of the block. When all the blocks around the circumference are in place the next step is the wiring, using soft iron wire, which is passed around the shell and pulled as tight as possible, the two ends being crossed to hold the tension. Starting at a point on the circumference opposite the meeting of the two ends of the wire, the helper starts to paddle the wire with short sharp blows coming toward the other man who takes up the slack in the wire produced by beating it into the magnesia block, the helper then goes back to his starting point and paddles it in the other direction until all slack has been taken up. The ends are then twisted together and tapped into the material.

While the wire is being taken up the helper is paddling the edges and all protuberances of the material to conform with the contour of the shell, thus taking care of all seams and joints. If there are full rivet heads in the seams a short section of blocking is placed around them, as in the under coat a space would be cut for the heads. The edge of this extra piece is well paddled to give a rounded effect.

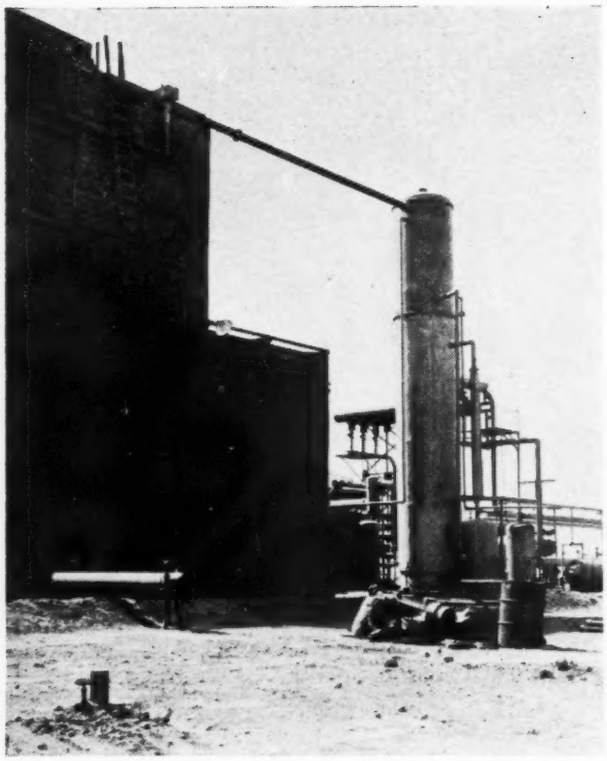
In placing the wire on 36-in. blocks five wires are usually used, the first two being three in. from the top and bottom and the other three equally spaced. Where there are nipples and fittings coming off the shell, the blocks are roughly cut to fit, and extra wires placed if needed, the idea being to hold the magnesia as tight as possible to the shell.

When a section has been completed and well rounded off with the paddles, small mesh chicken wire is then applied all around and the platform then moved to the next set of girts and the operation, as just described, repeated until the whole is covered.

The next step usually is for the helper to be preparing the asbestos cement, while


4 x 4 Posts
2 x 6 Girts
1 x 6 Bracing
2 x 12 Platform Movable
Still about 60 ft high
Light line for material
Duplicate on other sides

Scaffold for insulating a still. Cross bracing is conventional but from experience the type shown will be sufficient.



Photograph of an insulated still.

the other man is "chinking" up, which is the taking of small bits of magnesia and lightly beating them into all cracks and crevices, also fitting them around valves, fittings, and other projections, taking care to conform with the contours.

The asbestos cement, which usually comes dry in sacks, is well mixed with water to a rather wet consistency somewhat like thin mush, and must be well mixed from time to time as the water separates from it if left to stand any time. This cement is applied with flat trowels similar to those used by concrete finishers, and put on with a circular sweeping motion acquired by practice, care being taken to keep it evenly distributed over the surface, covering the chicken wire used as a bonding medium and avoiding lumps or dragging it off. All small cracks are filled with this cement, and the spaces around valves, etc., neatly finished off. Where there are any bolted joints, these are often left till the heat has been applied to the vessel and finally taken up, before "chinking" and cementing around the bolt heads.

All corners and fittings having been smoothly cemented, the work is allowed to dry, either with artificial heat or leaving to the sun. It is usual to apply two coatings, but if in a hurry one will do, if thick enough (about a quarter inch); however, two are considered more satisfactory.

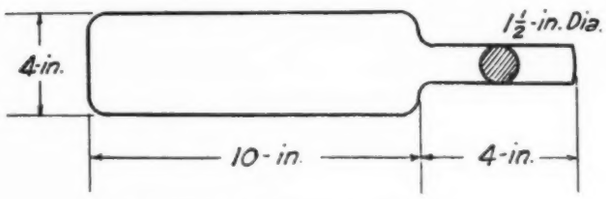
The next operation is the application of a weatherproofing coating of an asphaltic and membraneous nature. There are several varieties, and the right one for the special purpose will be recommended by the insulation manufacturers.

This often comes in barrels ready mixed, though occasionally it may require the addition of a little water to make it of a workable consistency. Here again it is a question of practice to make a neat application, as this is the final coating and the appearance of the whole job depends on this. It is applied in the same manner as the cement, the utmost care being taken to smooth out lumps and avoid the dragging appearance that will ensue if it gets too dry to be smoothed off with moderate pressure of the trowel. Around valves and fittings the cement is applied with a small pointer, carefully rounding off all edges and corners. This coating need not be so heavy as the cement, sufficient being applied to make the work moisture proof, about three-sixteenths of an inch being enough.

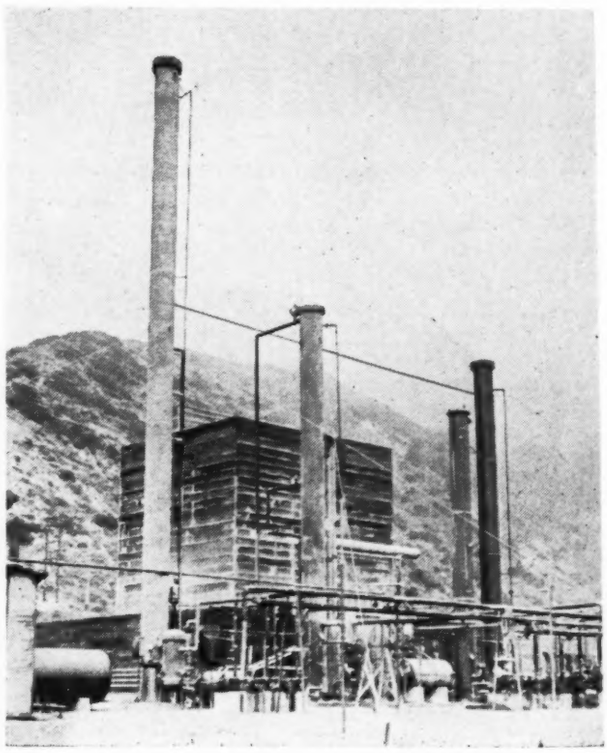
This asphaltic coating is in place of canvas, which is more expensive to apply and takes an expert to sew on neatly and make a very finished job. This coat, however, does not dry white but a dark grey color, so that it may not have the smart appearance of the canvas jacket, yet it is easier to repair, as a hole has only to be cemented and plastered with the asphaltic compound and it is as good as before.

This method can also be used around large valves and fittings, being far cheaper than the moulded insulation, and with a little practice can be built up and plastered so that it has just as pleasing an appearance as the mou'ded types.

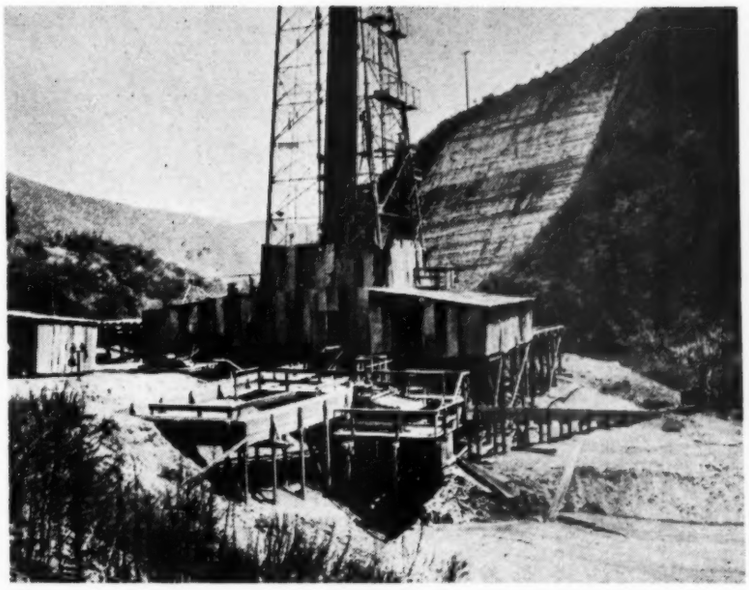
Regarding the time taken to insulate a vessel: from personal experience two men will block a 70-ft. still six ft. in diameter in ten hours, not including building the scaffold, but to include moving the platform from section to section. The same two men will apply the insulating cement in eight hours for each coating, and the asphaltic cement in 11 hours, also moving and mixing the materials. Such a still had a great many outlets such as thermometer wells, small test cocks, etc., all calling for small work with a pointer.



Paddle made from 2-in. x 4-in. lumber.



Insulated gasoline stabilizer.



The mud ditch and vibrating screens on Lloyd 136

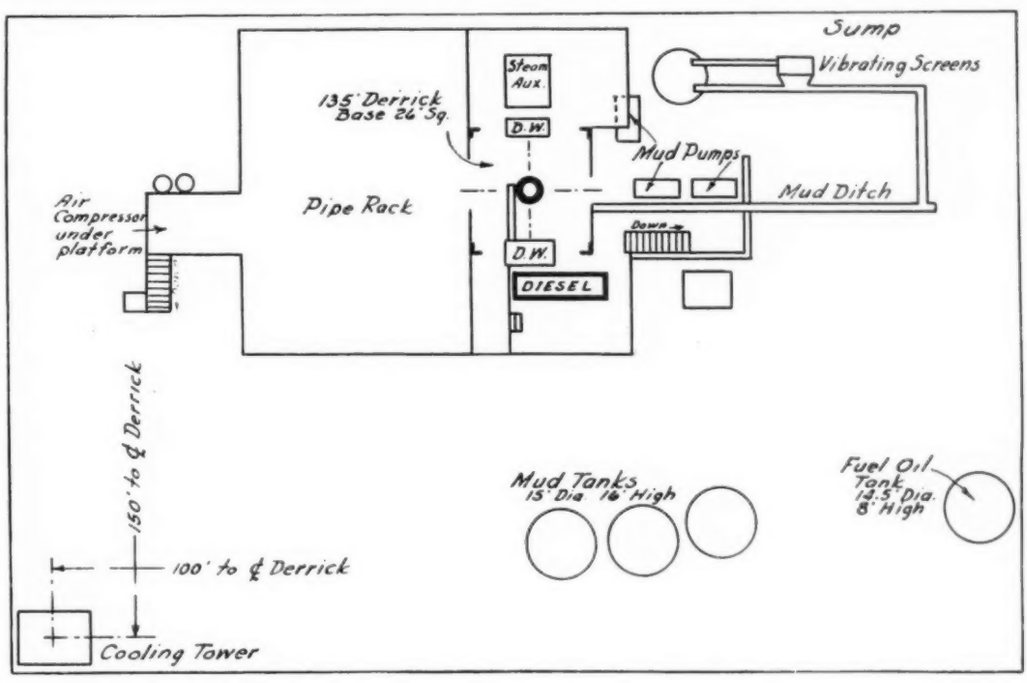
By
WALLACE A. SAWDON
Petroleum Engineer, Los Angeles

Direct-Reversing Diesel Drives Rotary on Deep Drilling Well in Ventura Avenue Field

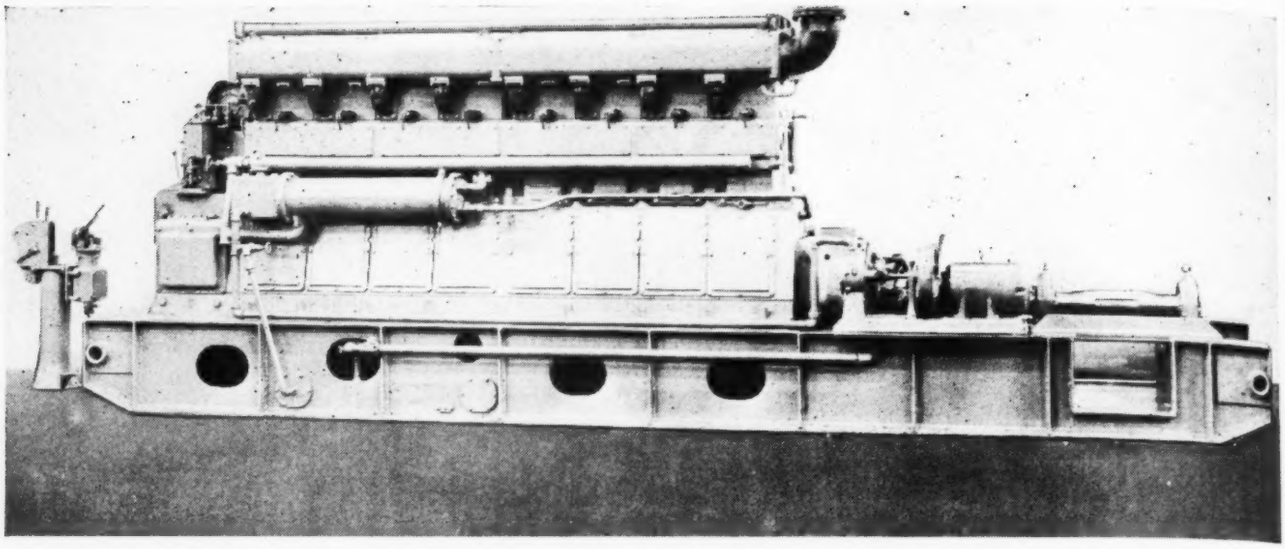
Adaptation of Diesel to drive rotary direct is innovation — Performance being closely watched

A DIESEL ENGINE serving as a prime mover direct-connected to the drawworks is now being used in the drilling of a deep well with rotary equipment in the Ventura Avenue Field, California. Diesels have been used for a number of years as prime movers in standard cable tool rigs; and about five years ago Diesel-driven direct-current generator sets were first employed to furnish power at the well for electric motors in rotary drilling. The adaptation of the Diesel engine as a direct drive for drawworks and rotary table, however, is the latest development and considerable attention has been focused on the installation by the Associated Oil Company on well Lloyd No. 136 at Ventura.

This well is to be completed at a depth of over 9000 feet. It was started on June 1, 1935, and surface pipe was run and cemented the following day, after drilling 125 ft. of 27-in. hole. A string of 18-in. casing was cemented at about 1150 ft. and, with the well down to below 6000 ft., the next string is about ready to be run. Due to the subsurface data



General layout of Diesel engine installation for rotary drilling on Associated Oil Company well, Lloyd 136, Ventura Avenue field, California



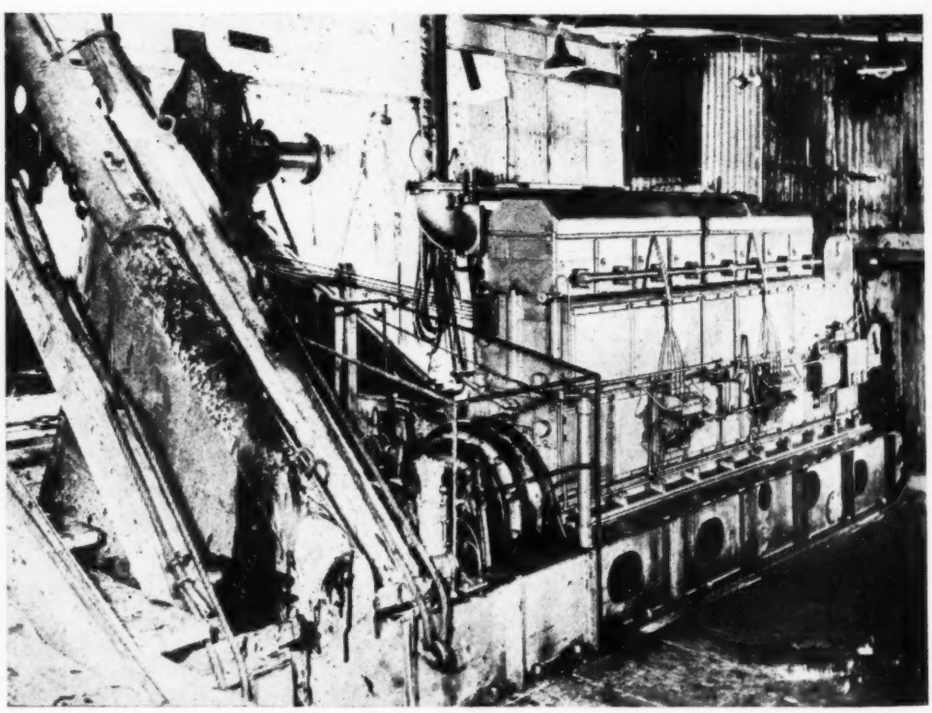
Shop view of fuel injector side of Cooper-Bessemer FP-8-DR Diesel oil engine, rated 400-hp. at 600 r.p.m., used on the well

available, casing programs on the Lloyd lease can be planned in advance with a considerable degree of accuracy.

In making the Diesel engine installation, it was decided to use this type of prime mover for the drawworks and rotary table only and thus make a thorough study of the performance of a direct reversible engine on such duty. In accordance with the practice of the company in drilling deep wells at Ventura, a stand-by drawworks and steam engine is placed opposite the main drawworks. There are three mud pumps operating on a level below the derrick floor, each with 14 x 14 steam cylinders and operating at a steam pressure of 145 lb. per sq. inch. Steam is supplied for the pumps through a 4-in. line from a central boiler installation. The arrangement of equipment is shown in an accompanying drawing. The reason for steam pumps instead of Diesel direct drive, was to satisfy everyone thoroughly on the adaptability of the reversing feature of the engine before "Dieselizing" the entire rig.

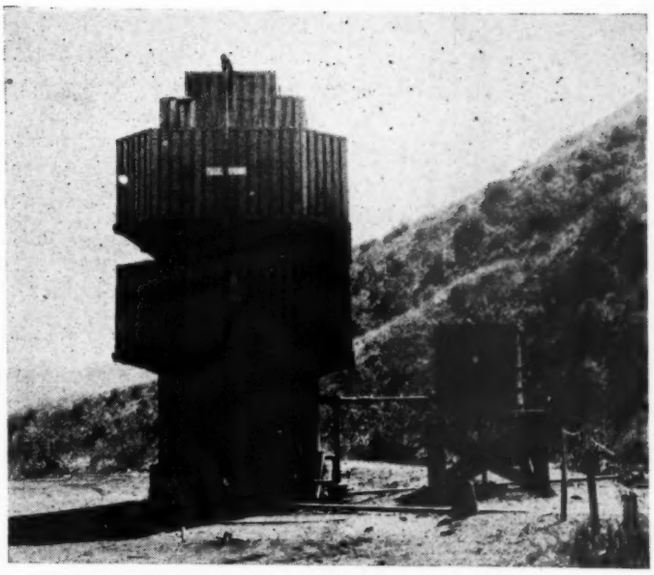
The Diesel engine driving the drawworks and rotary table is a Type FP-8 Cooper-Bessemer, 8-cylinder, 4-cycle, *direct- reversing* engine with 400 b.hp. at 600 r.p.m. It is assembled as a complete unit with a 24-in. Twin-Disc, air-controlled power take-off clutch built into the flywheel. From this is an extended shaft supported on both ends with self-aligning roller bearings and connected by a Thomas flexible coupling. Mounted on the shaft is a standard sprocket driving the drawworks shaft with standard rotary chain. There are no intervening jack-shaft or clutches between the engine and the drawworks since the engine is direct-reversing and the releasing of jaw clutches is taken care of by reversing the engine itself. The unit is mounted on a steel sub-base with one end turned up like a sled to facilitate skidding into position on the derrick floor.

To provide for flexibility, especially during hoisting, hand operation instead of governor control has been installed. The clutch is operated by compressed air and the starting, accelerating, and reversing are all done by the driller by means of a small control lever mounted on the post at the driller's position. Air operation of the clutch is felt to be absolutely essential since it allows the driller to keep his right hand on the brake lever. With air operation, an oil ram prevents the clutch from engaging suddenly and gives the operator plenty



Drive end from fuel distributor side of direct-reversing Diesel engine on Associated Oil Company well, Lloyd 136, Ventura Avenue field, California

The cooling tower is on a hill 150 ft. from the rig



of time to get his left hand from the clutch lever to the throttle.

The compressed air is supplied by an electric motor-driven compressor, which, with tanks, is under a platform built at the end of the pipe rack. Circulating water is cooled by a Fluor cooling tower erected on a hill about 150 ft. from the end of the pipe rack. Water pumps and oil pumps are driven by electric motors, because it was desired to confine the operation of the Diesel engine to driving the drawworks and rotary table only and thus be able to observe its performance on this duty without any interference from auxiliary equipment.

The average fuel consumption has been about one bbl. of fuel oil per day. One change of lubricating oil, requiring 50 gallons, was made during the drilling of about 5000 feet.

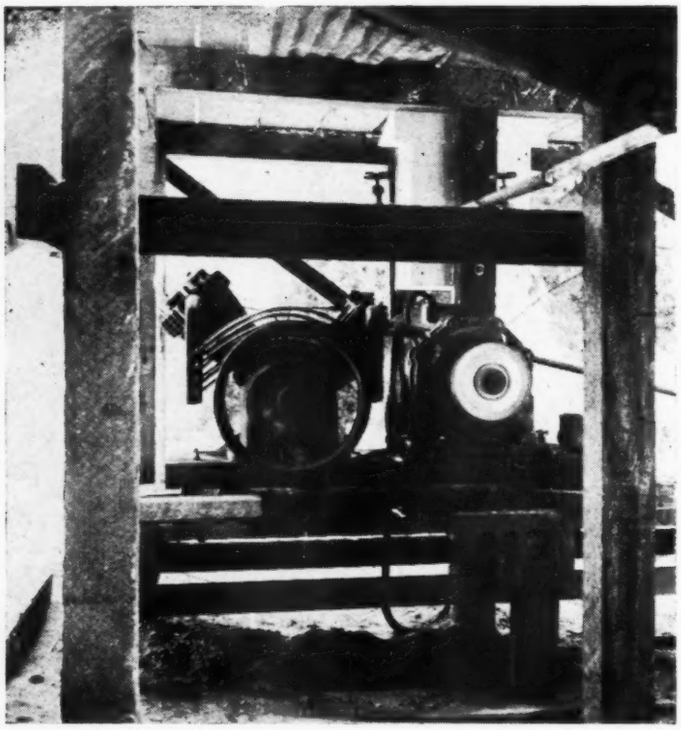
Due to many causes (probably including a farsighted desire by Mr. Warren, drilling superintendent, to break in a number of men to Diesel operation) nine crews have worked on the well since it was started. It was natural that unfamiliarity with this type engine caused a little roughness in operation at first. Many of the drillers were afraid of the friction clutch and insisted on using the jaw clutch entirely. After learning to handle the clutches properly, however, the operation was smooth. It was soon found impossible to use a governor except as an overspeed device, for drilling through steeply dipping rock formations becomes so rough that it is necessary for the power plant to cushion some of the action of the bit by being flexible in speed. A governor will not permit this and it is felt that a Diesel engine with governor control would damage the equipment when going through many kinds of formation.

A fixed setting of the hand control has been found most satisfactory. If the speed is permitted to drop after a bit grabs, the new Cooper-Bessemer injection system, which is under a constant pressure, has a tendency to increase the power impulse. This permits the speed to fluctuate with the operation of the bit and yet prevents the prime mover from stalling. The result is similar to that obtained with a steam engine.

During the hoisting operations it was found that smooth performance soon came with practice. The actual sequence in such operations was found to be somewhat as follows: Assuming a stand of drill pipe hanging on the hook ready to be hoisted, the engine is started with its clutch out; then with all jaw clutches also out, the engine friction clutch is thrown in and out quickly. This starts the cathead shaft and all chains, and while these are rotating—but with the friction clutch out—the jaw clutch for the proper gear ratio is thrown in. The inertia of the cathead shaft and chains brings the teeth of the jaw clutch into engagement; and at practically the same instant the engine clutch is thrown in and the engine given increased throttle.

With the hoisting operation in progress two methods of stopping the hook at any desired point have been used. One method is to cut off the engine throttle just as a block reaches the desired point in the derrick and at the same instant applying the brake to the drum. The engine clutch is then thrown out, the engine reversed and started for an instant in the reverse direction; with the jaw clutch thrown out and the engine stopped, it is reversed to the head position and started again when desired.

The Diesel engine is started, accelerated, and reversed by means of the two small levers here shown at the driller's position



The air compressor is driven by electric motor and is automatic

The other method is to throw out the engine clutch after the block reaches the desired point in the derrick without stopping the engine and at the same time catch the load with the brake.

An outstanding feature of this Diesel operation as observed by the writer is the speed with which it can be reversed. In pulling a string of drill pipe, the driller on the job had become so accustomed to the performance of the engine that he would catch the recoil of the flywheel and throw it into reverse without applying the air.

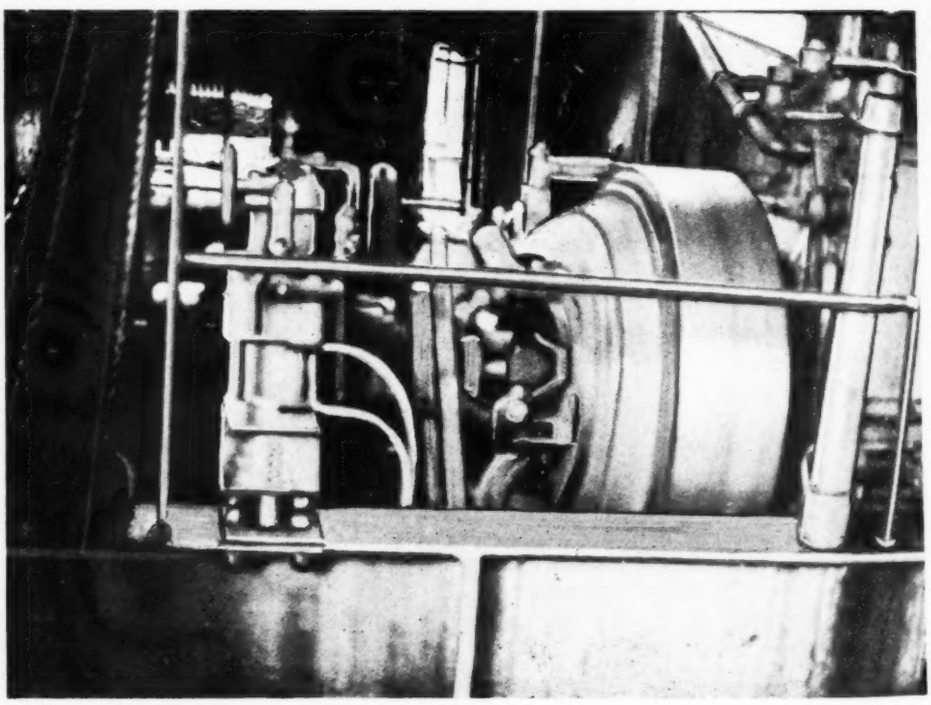
The drawworks being used for drilling this well is an old type Emsco without a jack shaft. The design was made for a more modern type of drawworks with the intention of direct-connecting the Diesel to a jack-shaft. Such latter designs of drawworks will provide for the proper gear ratios for the engine. The main objection to the present installation is the high speed of the catheads, which is caused by the inflexibility of the drawworks.

It is interesting to note that with the direct-connected Diesel, the engine runs only when in use, its speed probably within the range from 200 to 300 r.p.m. during rotation.

The initial investment of all types of prime movers will naturally be an influential factor in deciding the kind to select. There are also fixed charges to be considered. In fact every factor entering into the cost of prime movers should be weighed for all types of installation that are possible under existing conditions.

The performance of the Cooper-Bessemer direct-reversible Diesel is most interesting to study at the present time. This particular size and type for rotary drilling is especially adaptable because of the atmospheric pressure fuel injection system, which is ideal for direct-reversing. It is felt that the speed of drilling obtained by the installation in Ventura Avenue field is equal to that attained with other prime movers in that district. While the well is now below 6000 ft. in depth, there is little doubt about the power available with the Diesel engine. The problem has been to obtain a performance and flexibility equal to that provided by other prime movers and the results procured by this installation give promise of ultimate success along these lines. On the next well, however, it is the intention to use one of the latest type drawworks, a type that will, of course, smooth out the operation from that angle and give a more flexible outfit.

In view of the fact that engineers and manufacturers were not confident of the adaptability of this type of prime mover for rotary drilling, the Associated Oil Company showed a courage of conviction by installing the direct-reversible Diesel outfit in an effort to obtain an economy in initial cost and maintenance, and with performance at least equal to that of other types. The results have justified this conviction and the company has definitely contributed to the advancement of drilling technique.



The flywheel with enclosed clutch is here shown in operation while pulling a stand of pipe. The air ram is seen to the left of the clutch

Controlled Directional Well-Drilling and Surveying Practice

By JAMES D. HUGHES

Part III

IT has been the writer's privilege to examine the results of a great number of surveys and he has yet to encounter one that showed a well to be vertical. It might be said in humor that we approach the vertical as a limit.

In general the course of a well as projected orthographically upon the horizontal plane will fall under one of three classifications:

(1) A drifting in a radial direction along a gentle arc as shown in Fig. 10.

(2) A series of spirals as shown in Fig. 11, in which the hole resembles an irregular screw of great pitch.

(3) A combination of (1) and (2), in which after one or more loops the hole drifts off on a tangent, as shown in Fig. 12.

(NOTE: Illustrations Figs. 10, 11, and 12 are plotted from actual surveys.)

The spirals are usually in a clockwise direction, although an anti-clockwise spiral is very often encountered. Invariably those wells of low drift angle have the greatest tendency to spiral. Such was the case in Fig. 11, where in 7013 ft. of hole surveyed the average angle was 1 deg. 56 minutes. At low drift angles also the change in direction can be very abrupt, sometimes changing 180 degrees.

Looking at a survey plat for the first time many persons remark the seeming impossibility of such sudden changes in direction. The explanation is not so difficult of conception. A well may be drifting in any one direction at an angle of one or two degrees drilling in shale. Suddenly the bit breaks into a softer sand body and the hydraulicking action of the mud combined with the influence of gravity upon heavy drill collar, etc., pulls the hole vertical. The hole may remain vertical until another hard streak is encountered that may cause the hole to deviate again. Looking upon the horizontal plat this vertical section, whatever its length, is represented by one point. The next point evident on the plat shows the new deviation and direction, and gives the impression that the hole has changed abruptly in one survey interval. Correlation with the vertical section, however, results in a clearer mental picture.

There is evidence to support a statement that the tendency of the bit upon encountering harder digging is to drift up dip. This has been demonstrated in directional drilling where it is found much easier to build up drift angle when directing the well up structure than when directing it down.

This is easy to explain. When the rotating bit digging in the average shales—in which there are streaks of hard shale and shells or lime streaks bedded at a gentle angle—strikes the harder formation, the up-dip edge of the bit is retarded and momentarily held up while the down-dip edge is still in the softer formation. When there is considerable play between the drill collar and the wall of the hole, as is usually the case, the drill collar leans over in the hole so that the bit tends to dig perpendicular to the bedding plane.

When drilling through strata dipping at rather steep angles and a harder streak is encountered, the tendency is to slide on down dip. There does not seem to be any critical angle where the one tendency ends and the other begins. The relative hardness of the strata apparently has the greatest influence in determining this angle. (Fig. 13 illustrates the points just discussed.)

In the latter case a hole directed up structure by means of directional drilling has a decided tendency to slide off to the right or left, depending upon the horizontal angle of approach.

The causes of crooked holes are many and are both mechanical and geological. It is not the writer's intention to go further into a subject so generally understood. Others have published much during the time this problem was receiving universal and enthusiastic attention[9 to 16] (See references at end of article) and there is no doubt that as a result straighter holes have been drilled; as has been pointed out, however, the vertical hole is a rarity.

Realizing that a well is only rarely "bottomed" directly under the derrick unless deliberately completed there by controlled directional drilling, and more rarely surveyed to determine its positive underground location, it would appear that all geological and engineering conclusions premised on surface locations and spacings will be in error in some ratio to deviation.

From either a technical or practical standpoint the obvious advantages of oil well surveys are:

(1) Proper knowledge of the true vertical depths of geological horizons.

(2) Proper knowledge of the actual position of the well on the structure and its influence upon the accurate contouring of such structure.

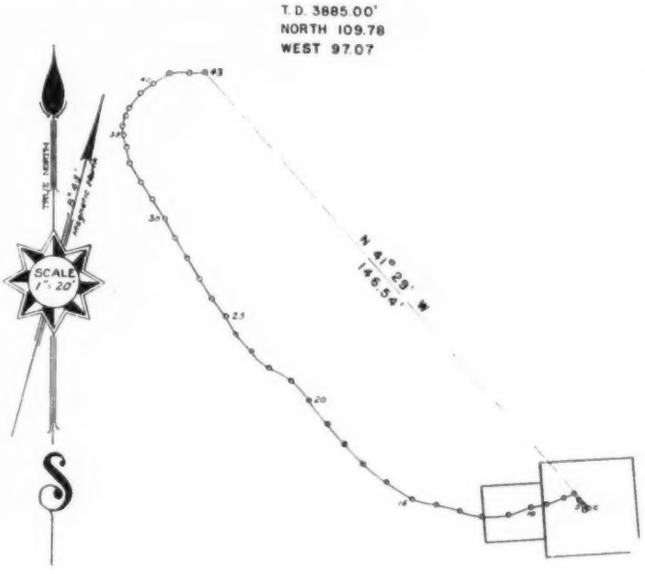


Fig. 10. An example of drifting in a radial direction along a gentle arc

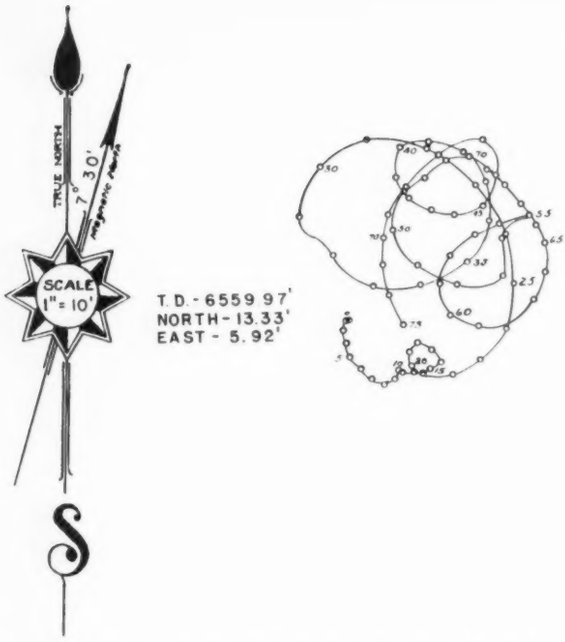


Fig. 11. An example of drifting in a series of spirals in which the hole resembles an irregular screw of great pitch

(3) More accurate indication of dip observed in core laminations.

(4) Aid in analysis of dynamometer results in weighing wells.

(5) Aid in correcting temperature observations in thermal gradient studies.

(6) Proper knowledge of the well's position on the reservoir in such considerations as:

a. Well spacing, interference, and economic drainage.

b. Determination of recovery and per acre yield.

c. Valuation of producing properties.

d. Prorated production based on acreage and potential.

e. Selection of input wells, etc., in repressuring and flooding operations.

The effect of a well's deviation upon these can neither be ignored nor lightly dismissed, unless, of course, the deviation is so small as to be negligible.

Consider the matter of well spacing and interference. There has been a great deal of discussion upon the subject of well spacing at the surface and very little about the more important bottom-hole spacing.

In a field where 300-ft. spacing is the rule the following table shows the average drift angle that could cause complete coincidence or interference at different productive depths:

Depth	*Average Drift*
3000 ft.	2° 55′
4000 ft.	2° 09′
5000 ft.	1° 43′
6000 ft.	1° 26′

Although present development on large tracts is based on much greater spacing, the above indicates the possible economic waste attendant upon close spacing and town lot drilling. It will be noted that in each case the angle falls within the arbitrary 3-degree limit written into most drilling contracts.

Wider spacing on present deeper production runs the same danger. At an average drift of three degrees an 8000-ft. well can deviate 418 ft., which would allow coincidence at 800-ft. spacing.

From Cutler's statement[17] that "the ultimate productions for wells of equal size in the same pool, where there is interference, seem approximately to vary directly as the square roots of the areas drained by the wells,"—the matter of interference, even partial, plays an important part in recovery.

The value of a well as an investment bears directly upon the effective area it drains, and that value is reduced in proportion to interference.

The fallacy of basing calculations of reserve, per-acre yield, value, etc., upon the assumption that all wells upon a property are vertical may be visualized from Fig. 14.

In this hypothetical illustration the six wells were drilled with a spacing of 300 ft. on a structure dipping gently to the northwest. Assume that in drilling to 5000 ft., under structural and mechanical influences the wells drifted in the directions and distances indicated. That this condition could exist where no surveys, or only verticality tests were taken is possible when considering the angles assumed in the following table:

Well No.	*Drift Angle*	*Horizontal Deviation*
1	2° 00′	174.
2	1° 10′	100.
3	3° 00′	261.
4	0° 52′	75.
5	1° 45′	150.
6	2° 05′	180.

Assuming the producing sand to be of uniform thickness, porosity, and saturation, and ascribing to each well a drainage radius of 150 ft., the resulting interferences are as shown in the hatched areas.

Without going into detail it is quite obvious that Well No. 4 is something of a loss and that the application of production figures

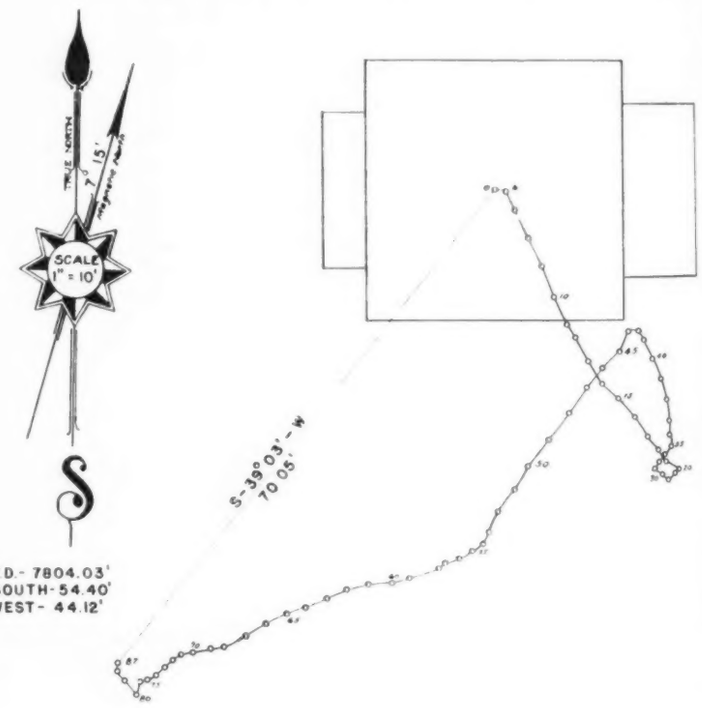


Fig. 12. Drifting in this hole is a combination of that shown in Figs. 10 and 11. After one or more loops the hole drifts off on a tangent

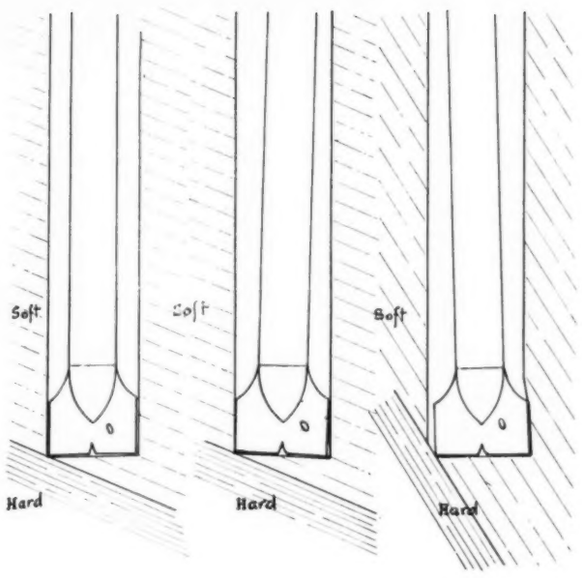


Fig. 13. Illustrates the influence of dip of hard strata upon deviation

from the concentrated drainage areas to the lease as a whole would lead to some interesting differences.

Should it be desired to repressure such a lease as that illustrated, the choice of an input well would probably be based on production figures. By assuming the wells to be vertical any choice would be more or less blind. The writer has seen special wells drilled as input wells on what is called the "five spot" location equidistant between four wells, and with no knowledge of the bottom location of these four wells or the final location of the "five spot" wells. Obviously, a knowledge of the bottom locations in this type of work would be of the greatest practical benefit and would no doubt solve many problems.

From the standpoint of the geologist whose job it is to take the information gained from many wells and interpret the whole into an orderly and plausible picture, the knowledge of extent and direction of the deviation in the various wells is of the greatest value. Lack of this knowledge gives rise to the anomalies which no doubt Estabrook had in mind when he referred to a crooked hole as an "alibi for geologists."

The influences of deviation upon geological interpretation has been liberally discussed by Lahee.[9]

The natural corallary to oil well surveying is controlled directional drilling, for by its assistance is made possible the corrections, the need for which is revealed by the surveys.

The writer has previously defined "Controlled Drilling" as that type of drilling where the mechanical factors that cause deflection are kept in control.[18]

These factors, over which the operator has selective control, are, briefly: size of hole, size of drill pipe and drill collar, type of bit, choice and position of reamers, speed of rotation, rate of circulation, effective weight on bits, and choice and condition of drilling fluids. The objective of controlled drilling has been a vertical hole.

Controlled directional drilling on the other hand may be defined as that type of drilling that has control of the same variables as outlined above, but with the addition of special deflecting tools and experience, which combined, permit the completion of a well at any reasonable predetermined point.

There are past references of wedges of whipstocks that have been oriented into a bore hole to deflect the hole in a required direction. In all these instances, however, the wedge or whipstock had been permanently cemented in the hole; in fact the first controlled directional drilling done by the Eastman organization was by means of cemented whipstocks.

It is interesting to recall that to facilitate rapid cementation a pioneer European whipstocker conceived the idea of inclosing a quantity of cement within the body of a wedge having a plate of glass holding it in such a fashion that when the wedge was set down on bottom a plunger broke the glass and released the cement.

Leaving permanent whipstocks in the hole, however, has never been a popular practice; rather has it been avoided unless absolutely necessary.

It was not until the invention of the open-hole removable whipstock by H. H. McVicar[19] and its subsequent development that controlled directional drilling became really practical and got its start.

Directional drilling as employed today is, one might say, a new oil field science. It brings a new and greatly appreciated precision to sub-surface operations, an aid of great utility to drilling everywhere that can be used to great economic advantage.

Controlled directional drilling requires four things:

1. One or more proven deflecting tools.
2. A means of setting the tool in the required direction.
3. Experience in the factors of deflection.
4. A surveying instrument to check the settings and the progress of the directed hole to its objective.

To which, of course, must be added a hole to deflect.

[9] "Problem of Crooked Holes," by F. H. Lahee—A.A.P.G. Bulletin, Vol. 13, No. 9, September, 1929.
[10] "Causes and Effect of Crooked Holes," by E. J. McKee—*Oil and Gas Journal*, November 22, 1928.
[11] "The Crooked Hole Problem," by W. R. Cummings—*Oil and Gas Journal*, September 13, 1928.
[12] "Cause and Effect of Crooked Holes," by D. R. Snow—*Oil and Gas Journal*, April 4, 1929.
[13] "Pioneers Had Crooked Hole Problem," by H. B. Goodrich—*Oil and Gas Journal*, April 4, 1929.
[14] "Frequent Surveys Check Crooked Hole," by Hardison and Warner, *Oil and Gas Journal*, April 14, 1929.
[15] "Straight Drilling of Rotary Holes," by R. D. Elliot—*Oil and Gas Journal*, May 9, 1929.
[16] "Discussion of Crooked Hole Problem," by L. J. Black—*Oil and Gas Journal*, November 29, 1928.
[17] "Relation of Drilling Campaign to Income from Oil Properties," by W. W. Cutler, Jr., and Walker S. Clute—U.S.B.M. Report of Investigations, 2270, August, 1921.
[18] "Value of Oil Well Surveying and Applications of Controlled Directional Drilling," by James D. Hughes—Paper, given at Spring meeting, Mid-Continent District, A.P.I. Division of Production, Amarillo, Texas, April 10-11, 1935.
[19] U. S. Patent No. 1,970,761, 1934.

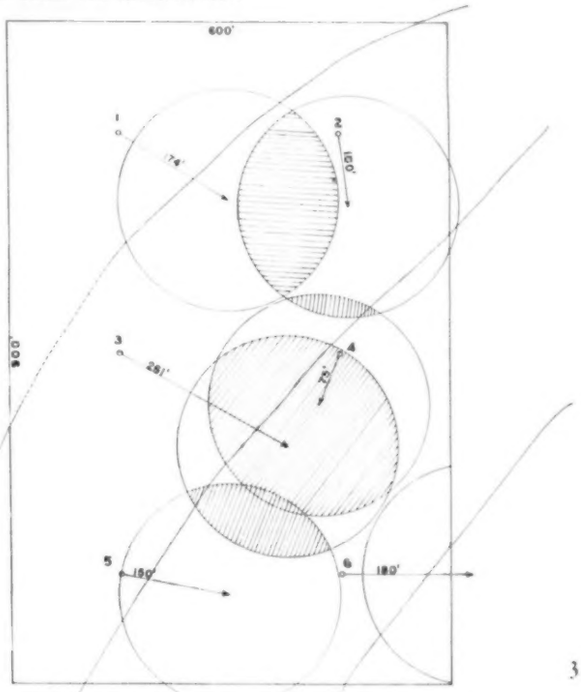


Fig. 14. Here is illustrated the fallacy of calculating reserves, per-acre yield, etc., on the assumption that all wells are vertical

The Manufacture, Packaging, and Shipping of Oxidized Asphalts

By CHAS. J. HOLLAND

Article 8

IN this article will be recommended the best type of equipment and operating methods for application of the 15 fundamental principles to the job in hand—the design of the Mexico plant.

The charging stock will be fire-heat and steam-reduced Panuco crude oil coming from storage at not less than 200 deg. fahr. hot and at a penetration test around 200. Typical characteristics of crude and two possible charging stocks are:

TABLE 9

Panuco Crude		Charging Stocks of 180-200 Pen.	Charging Stocks of 135-150 Pen.
Sp. Gr. @ 60° F		1.0345	1.0375
Flash Point	100 (CC)	450 (CC)	465 (CC)
Vis. Furol @ 122° F	600	.....	.....
Percent Sulphur	5.0	.....	.....
Percent Paraffin	0.50	0.55 Max.	0.55 Max.
Pene. @ 77° F	.....	187	147
Ductility @ 77° F	.....	110 Plus	110 Plus
Sol. in CS_2	.....	99.94%	99.92%

Typical characteristics of finished products to be manufactured may be noted from Tables 3 and 4, the oxidized products made in the Hamburg plant. It is worth observing their comparison with those of Table 1, the specifications and typical analyses of oxidized asphalts of Plant 1 in 1916-18, made from Texas Coastal Crude oil, as shown in Table 10, following:

TABLE 10

	Grade	From Tables Nos. 3 & 4	Grade	From Table 1
B&R. M.P. °F	XI	176–194	A	175–185
Sp. Gr	"	1.042	"	1.014
Penetration	"	20–30	"	35–65
Ductility	"	5–15	"	6
Percent Sol. in CS_2	"	98 Min.	"	99.31
Percent Combined Carbon	"	16–18	"	15.4
Percent Paraffin	"	0.55 Max.	"	0.56
B&R. M.P. °F	XIII	230–248	B	235–245
Sp. Gr	"	1.050	"	1.020
Penetration	"	10–20	"	15.20
Ductility	"	2–3	"	3
Percent Sol. in CS_2	"	98 Min.	"	99.57
Percent Combined Carbon	"	18–20	"	16.5
Percent Paraffin	"	0.55 Max.	"	0.50
B&R. M.P. °F	XIV	257–275	C	250–265
Sp. Gr	"	1.060	"	1.020
Penetration	"	5–10	"	10–15
Ductility	"	1–2	"	2–1
Percent Sol. in CS_2	"	99.8 Min.	"	99.30
Percent Combined Carbon	"	19–22	"	17.36
Percent Paraffin	"	0.55 Max.	"	0.48
B&R. M.P. °F	XV	329–347	E	290–310
Sp. Gr	"	not given	"	1.034
Penetration	"	2–5	"	6
Ductility	"	0	"	1.1
Percent Sol. in CS_2	"	not given	"	99.64
Percent Combined Carbon	"	" "	"	19.60
Percent Paraffin	"	0.55 Max.	"	0.60

The differences to be noted are in tests of specific gravity and fixed carbon contents; otherwise they are remarkably alike.

Pumps, Lines, Valves, Fittings, Air Equipment, and Stills

Pumps: Calculating on basis of Principles 3 and 10, two pumps with standbys will be required, one each for charging stock and reflux. They preferably should be steam-driven Kinney type S-D steam-jacketed rotary pumps, good for maximum discharge pressure of 150 lb. gauge. Required capacity of charging pumps is:

$(5 \times 6) + .07\ (5 \times 6) = 32$ lb. per hr. or 768 bbl. per day.

This is based on five tons per hr. maximum product output, six bbl. to the ton, and an average of seven percent of losses through oxidation and mechanical entrainment. The reflux pump may be approximately half this capacity. If on infrequent occasions it becomes necessary to reflux entire product output this may be done by use of regular reflux pump plus its standby.

When necessary to pump out a still for cleaning or repairs provision should be made for two means. One should be the Plant No. 2 method of blowing out with 30-40 lb. steam pressure and the other by use of the two standby pumps.

Lines, Valves, and Fittings

All lines, valves, and fittings should be standard type good for 125 lb. maximum pressure. All lines for finished asphalts and connections to stills for pumping in or out should be six inches in diameter; of shortest possible length; least number of fittings; designed to avoid pockets; a gravity flow incline wherever possible and practicable; with no steam-heating inside or outside (i. e. steam-pipe or steam-jacket); and no insulation of any kind. Design should anticipate need of accessibility for heating lines, valves, or connections with hand fires of wood, oil, or gas that occasionally may be required due to a freeze-up resulting from becoming cold through non-use.

There should be no regular type expansion joints in these lines because with hot asphalts and asphalt-like products they leak too greatly and are costly in first and maintenance cost. Indeed, for short lines, such as flow-line, the use of the Crane type corrugated spool expansion joint is preferable. They are cheap, reliable, have no packing glands to cause constant leakage and expense, and if desired they can be made on the job by a welder-mechanic. For long lines to and from storage tanks and receiving vessels one should use the regular type expansion pipe bend.

When the use of a line is discontinued for any reason it must be blown out immediately with high-pressure air. Steam is not suitable due to danger of water condensation. When blowing out, for example, a line to a storage tank or receiving vessel there should be a gate valve as close as possible to the extremity where it joins the tank or vessel. Then as air-blowing is being completed begin gradually to shut off on the valve. This makes a small opening at the valve, thus preventing air from blowing out above the bottom layer of asphalt in the line. If for any reason there is occasion to blow out into tank or receiving vessel where either is below a temperature of 240 deg. fahr., the tank or vessel should be first heated (by steam coil or underneath oil or

gas-fire heating) until this temperature is reached, in order to avoid danger of explosion. If tank or receiving vessel contains as much as a 4-ft. depth of hot liquid and blowing takes place through this depth, experience has proved this precaution to be unnecessary.

Never pump, or blow out by steam, a still through a line that has been out of service an hour or more without first testing line with air pressure to determine if it is clear and open. If there is a plug in it, it will thus be discovered, located, burned out and line cleared. Otherwise there is a possibility of plugging up solid the line from beginning to location of plug. The position of the plug is determined by hand-hammer blows on the line.

If a still must be emptied quickly while at high temperature (i. e. above 400 deg. fahr.), use a 6-in. continuous series water-box coil, pumping through at relatively high velocity. If by chance this plugs up, empty out the water, make an oil fire in box with oil-soaked waste or heat pipe with gasoline blow torch, then apply high-pressure air to clear the coil. Water in box should be hot before pumping is begun.

All valves should be ordinary gate valves with cast-iron stop cocks. Cast-iron core cocks are cheaper and are quite satisfactory for all services except at points referred to in above paragraphs relative to long lines that must be cleared out completely after use by air-blowing. On flow-line connections on stills cast-iron gate valves are preferable. In any case, it must be anticipated in design work that all valves or cocks, the same as fittings and lines, may occasionally be subjected to outside oil-, gas-, or wood-fire heating, due to freeze-ups.

Air Equipment

Air to be furnished will be at 15 lb. gauge pressure and at rate of 1500 cu. ft. per bbl. of finished product. All air equipment design work should be on this basis.

Compressed air production may be by a single-stage compressor of reciprocating, rotary, or centrifugal motion. The Elliott Company machinery, as described in Part Three, is recommended. The required capacity is:

$$\frac{1500 \times 32}{60} = 800 \text{ cu. ft. per min.}$$

Since there are discrepancies in the literature and among the experts, and also with future expansion of plant in mind, the writer recommends installation of two machines of 1500 cu. ft. per min. capacity, one for regular service and one as stand-by equipment.

For blowing out lines and for air-hammer repair work, high-pressure air facilities must be plentifully available. This can be arranged for through the regular refinery high-pressure air service system.

Stills

For exact calculations on design and number of stills for the particular type of charging stock to be used, there are unfortunately no continuous plant experience data to go on. The problem can best be approached and solved by making all calculations on basis of Plant No. 1 data, then by use of fundamental principles and a meager amount of batch-running experience data, calculate the necessary conversion factors for changing over to the charging stock and other local conditions of the job in hand.

According to principles laid down in Articles 6 and 7 for the stills it is desirable to have:

A—Finished product output not in excess of five tons per hr. per battery.

B—Vertical walls.

C—Small diameter-height ratio.

D—Large number per battery.

E—Oil- or gas-fire heating.

F—Settings of same height, and level gravity flow line.

G—Means for mechanical agitation of liquid.

H—Utilization of a system of internal reflux.

I—Means for continuously producing simultaneously two or more grades of finished products.

J—Means for simultaneous and continuous production of steam-refined and oxidized asphalts.

By reference to data in previous articles it will be noted that Plant No. 1 possessed eight of these ten desirable features. The two the plant did not have were A and H. Capacity was shown at the rate of 2.08 tons per hour. The idea of H is a conception of recent date and not as yet tried out commercially; it must therefore be omitted from the calculations.

The items of immediate chief interest are selections of most efficient and practical figures for diameter, height, and number of stills per battery. According to A only one battery can be built.

On basis of Plant No. 1 experience data the simplest way out would be to build two batteries of eight stills each, exactly like those of Plant No. 1 stills. This however would call for excessive plant investment cost, great land area, and would not be in keeping with item A.

Since experience has shown that limits for satisfactory compliance with item D are from five to eight, the number of stills in the battery must fall within these limits. With Plant No. 1 stills, the first two served as a preheater for bringing charging stock up to initial oxidizing temperature. They might have been less costly and more efficiently replaced by a pipestill pre-heater and/or the internal reflux system of item H. But for the moment consideration of these two features will be omitted.

As to diameter and particularly as regards first two or three stills where, without pipe pre-heater and/or internal reflux, continuous rapid firing must be done, there are three controlling factors: (1) Heat transfer from oil or gas fire to liquid within the stills, (2) still setting, and (3) furnace volume.

Though good heat transfer is much facilitated by mechanical agitation, special care must be taken as regards the first three stills. There must be ample furnace volume for complete combustion of the fuel so as to avoid flame coming into contact with metal of still bottom and also to avoid secondary combustion in flue gas conduits. The still setting must be such that not too much of the bottom area is covered with brickwork supporting piers. If this does occur, heat transfer will be that much less effective, in proportion to the metal area removed from contact with the hot gases of combustion. Evidently, if the number of sq. ft. of metal surface exposed to radiant and convection heat from the furnace is too small, there will result a heavy coke formation on bottom of still. This would call for frequent still cleaning and costly still bottom repair work. It is advisable, therefore, to remain on the conservative side of these three con-

trolling factors as regards the first three stills if no pipe pre-heater and/or internal reflux system are to be used.

In these respects the Plant No. 1 experience was satisfactory. It was: The heating of 13.4 bbl. per hr. of charging stock from 200 to 300 deg. fahr. through $\frac{5}{8}$-in. plate, with liquid depth of six ft., furnace volume of 514.5 cu. ft., and 73.5 sq. ft. of metal surface exposed to the hot combustion gases. (See Table 6.)

Calculations

(1) Furnace volume: height of still bottom from ground is seven feet. Brickwork supporting pier: 27 in. sq. by 7 ft. high = 35 cu. feet. Therefore:

$$\pi R^2 \times H = (78.5 \times 7) \text{ less } 35 = 514.5 \text{ cu. ft.}$$

(2) Metal surface: 78.5 minus 5 sq. ft. (taken up by brick pier) = 73.5 sq. ft.

(In reality, liquid depth somewhat exceeded six ft. because of necessity of some head to allow for gravity flow from still to still through the level flow line. But the assumption of six ft. is sufficiently accurate for our purpose here.)

With first two stills, which are below initial oxidizing temperature, the quantity of heat transferred is directly proportional to total number of sq. ft. of heating surface exposed to combustion gases. Accordingly, still diameter required would be approximately 15½ feet.

Calculations

(1) 13.4: 32 = 73.5: X, where X = 175.5 sq. ft. To this must be added area taken up by brick pier, assumed to be 12 sq. ft., hence 175.5 plus 12 = 187.5. From standard tables, 15½-ft. dia. gives approximately 187.5 sq. ft.

(2) The furnace volume would be in the same proportion; i. e. 13.4:32 = 514.5:X, where X = 1228 cu. ft. This, divided by 175.5 gives a still setting of seven feet.

For calculating height required, reference is again made to Table 6. There it is seen that with the Plant No. 1 still of 10 ft. x 10 ft. a liquid volume was present of 84.1 bbl. per still when making 2.08 tons of asphalt per hr. from an 8-still battery.

Using same number per battery and making five tons per hr. of asphalt, the liquid volume of the 15½-ft. still must be 202 bbl. because: 2.08:5 = 84.1:X, where X = 202. Also from Table 6, it is seen that with all stills a minimum vapor space of 314.41 cu. ft. is required in order to avoid excessive mechanical entrainment losses. 314.41 divided by 5.6 = 56 bbl.; thus, 202 plus 56 = 258 bbl., or the total still volume required. Since a still 15½ ft. in dia. holds 33 bbl. per ft., it is evident the still height must be a little less than eight feet.

Therefore, to have a product output of five tons per hour when operating under Plant No. 1 conditions there would be required a battery of eight 15½-ft. x 8-ft. stills set up at seven ft. above ground level.

The next thing to do is, with the aid of the meager batch still experience data, to develop conversion factors for changing over to the Mexico plant conditions.

As seen from Table 10 there is not much difference in characteristics of product output so that for this item no conversion factor is needed. As to the two types of charging stocks there are important differences. From viewpoint of still design they are percents of sulphur and concentration. With the Mexico charging stock both are a great deal higher. This means less time and air will be required per ton of product output, as compared with Plant No. 1 charging stock. As with other local conditions, they are sufficiently close to require no conversion factors.

From notes taken on Plant No. 2:

(1) "Typical run on a converter: Charge 400 bbl. (67 tons)—time: 30 to 40 minutes. Temperature—180-240 deg. fahrenheit. Heating in converter to 470 to 520 will require about two hours, but must have some air in spiders to keep it agitated. After full air turned on, when going for 0 to 5 pen., fires required. Can blow to 150 pen. product in 24 hours; for 0 to 5 pen. requires 85 to 95 hours. These figures on basis of charging stock similar to Plant No. 1 stock, with not more than 10 percent Mexican present."

(2) "Very difficult to steam reduce after 200 M.P. To steam reduce with 100 per cent Mexican stock of 200-230 pen. down to 200 M.P. will take four days, whereas with air could do it in 24 hours."

(3) "When using 100 percent Mexican stock running from 200 pen. to 50 pen. (150 M.P.) steam-reducing will use about 100 lb. steam per bbl. of charging stock, with liquid temperature in still of 630-640 deg. fahrenheit. This would give a ductility around 100. But if this is done entirely with air, ductility would be 35-40."

(4) "Takes 24 hours blowing to come to 100-150 pen., then 48 hours blowing down to 250 M.P. Therefore if start with 100-150 pen. and use 100 percent Panuco stock will oxidize it to 250 M.P. in 30-35 hours and use ten to 15 percent less air."

(5) "Using 2/3 Mexican and 1/3 Texas charging stock, blown to 195 pen. takes 1500 to 1800 cu. ft. per bbl. charging stock. Mexican stock takes 10 to 15 percent less air than Texas stock. Starting with 240 pen., 100 per cent Mexican then steam reduced to 230 M.P. took 96 hours. With air, do same thing in less than half or maybe no more than one-third the time."

(6) "For 50-60 pen. use 1900 cu. ft. of free air per bbl. of finished asphalt when starting with domestic residuum of 1100 at 210 deg. fahr. viscosity. This varies to some extent with crude. Domestic residuum may be anything except Venezuelian, Torrance (Calif.), or Mexican. For 35 to 40 pen. 2200 cu. ft. air per bbl. asphalt. For 240 pen. 1000 to 1300 cu. ft. of air per bbl. asphalt. All figures based on domestic residuum."

(Note: In studying Plant No. 2 data it must be remembered: no mechanical agitation; no vertical stills; and no continuous operation; therefore, air and time requirements greater than with Plant No. 1.)

From Table 6, it is noted that total liquid volume in stills was 673 bbl. and charging stock at rate of 13.4 bbl. per hour, hence, on the average, it took 50 hours for heating and oxidation. According to (2), using Mexican stock of 200-230 pen. (presumably about 200 deg. fahr. temp.) can go to 200 M.P. in 24 hours; according to (4), with 100-150 pen. can go to 250 M.P. in 30-35 hours. Therefore, with Plant No. 1 but using Panuco charging stock of 200 pen. and going to 250 M.P., it seems safe to estimate the heating and oxidizing time at 35 hours. We have then the charging stock conversion factor of: 50 : 35 = 1 : X, where X = 0.7. Accordingly, the number of 15½-ft. x 8-ft. stills required when using Mexican charging stock would be 8 × 0.7 = 5.6, or in whole numbers, six stills.

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There are two undesirable features about a battery of six 15½-ft. x 8-ft. stills. The diameter-height ratio is too small. With incoming charging stock at 200 deg. fahr., the first still acts as a preheater only and does no oxidizing work. The only way to change the first objection is to change the second. The diameter cannot be reduced because a smaller one would result in unsatisfactory heat transfer conditions. To right this, there are two means available; a pipe heater and/or internal reflux system. Though it is recommended provision be made for it, internal reflux must not be relied upon 100 percent until proved up in practice. A small pipe-still preheater should be added for heating 32 bbl. per hour charging stock from 200 to 375 deg. fahrenheit. This will add the equivalent of one still and will greatly lighten the heat transfer load on all, especially the first two.

Since experience teaches best to have large number, it is better not to reduce below a 6-still battery. From above calculations, it is seen that six 15½-ft. x 8-ft. stills have a liquid volume of $202 \times 6 = 1212$ barrels. The pipe heater reducing this by one, there is required a 6-still battery of liquid volume of $202 \times 5 = 1010$ bbl., or 168 bbl. per still.

The questions now remaining are, what diameter and diameter-height ratio to use? From viewpoints of still settings, furnace volume, and heat transfer, I believe experience demonstrates it to be good practice to stay within limits of 10 and 14 feet. Using whole numbers, there would be five from which to select (See Table 11, following):

TABLE 11
Characteristics of Stills

In Feet		Volumes in Bbl.			Liquid	Sq.Ft.Heat.	
Dia.	Ht.	Vapor	Liquid	Total	Depth	Surface	Ratio
10	16 0	56	168	224	12	67 5	1:1 6
11	13 3	56	170	226	10	95 0	1:1 2
12	11 3	56	170	226	8 5	113 1	1:0 9
13	9 3	56	166	222	7	132 7	1:0 7
14	8 0	56	165	221	6	153 9	1:0 6

Summing up and having in mind all calculations in this section, those of Tables 6 and 11, the experience of the experts and the writer, the following are recommended for the still equipment of the Mexico plant:

1—A pipe still preheater for charging stock.

2—Use of internal reflux system.

3—A battery of six stills, each of 11 ft. dia. by 14 ft. high, having operating liquid depth of 10 feet.

1—Preheater to be of series type flow; 3-in. inside tube diameter; standard radiant-convection heat design; cold oil velocity at three ft. per sec.; heating 32 bbl. of charging stock per hour from 200 to 375 deg. fahrenheit. Radiant heat absorption to be not in excess of 70 percent of total.

2—Internal reflux system to be set up and used as previously described.

3—Stills to be in accordance with items A to J; the notes given below; and with Plant No. 1 drawings.

Such still equipment for Mexico conditions will satisfactorily produce 120 tons of high melting point asphalts per day. It will operate throughout the year at a minimum of 85 percent working time efficiency, thus giving a per-calendar day output of 100 tons or 3000 tons per 30-day month.

NOTES—In making up still designs from Plant No. 1 drawings, important alterations, and improvements should be made, and other points considered, as follows:

A.—Stills should not be supported on the brickwork of furnace. They should be set up on cast-iron pipe supports the same as is sometimes done with horizontal shellstill batteries. This method is well understood by designing engineers, making unnecessary a detailed exposition. Setting of stills by Plant No. 1 drawings has the drawback that all weight rests on brickwork of furnace. When the firebrick expand and begin to spall off from continued heating, the weight of the still greatly aggravates furnace repair work.

B.—A more efficient and less expensive means of power transmission to stirring device should be used. Plant No. 1 used a long manila rope drive. When ropes were new they were tight but with aging they became loose, causing loss of power and need of idler wheels. Also, in rainy weather they became tight, while on hot and dry days extremely loose, thus requiring an excessive amount of slack in ropes.

One of two better means should be adopted, either of which will be less costly, more efficient, and quite satisfactory. They are: (1) chain and sprocket, or (2) V-type belt drive. If chain and sprocket are used then in the sprocket hub a brass or other soft metal key to shaft must be employed so as to avoid difficulties in event shaft and paddle become stuck or wedged tight in still. If this happens the soft metal key will easily shear off and no other damage will be done.

Regardless of whether chain and sprocket or V-type belt is used, it should be short; short enough so that the line drive shaft for all may be set up and supported on tops of stills. Such supports with their roller- or plain-bearing boxes may be welded on tops of stills, thus avoiding long belts or chains and separate, more distant line-shaft and bearing supports as used with Plant No. 1 stills.

The prime mover for line drive shaft to be 25-35 hp. and may be electric motor or steam engine. The r.p.m. of paddle shaft in still to be 18-20.

C.—Gross heating surface of 15½-ft. dia. still is 187.5 sq. ft.; for 11-ft. still, only 95 sq. ft., or approximately one-half. Thus, with the 11-ft. still, were there no pipe heater and/or reflux to be used, it would satisfactorily heat only one-half of the hourly charging stock throughput of 32 barrels. In other words, the first two of the 11-ft. dia. stills must carry only one-half of the transfer heat load as that calculated for 15½-ft. still.

For the 15½-ft. still set up seven ft. above ground level the furnace volume is 1228 cu. ft. Since the 11-ft. still will be doing half the heat work it may have half the furnace volume, or 614 cu. ft. This requires a 6½-ft. setting above ground level: i.e. $95 \times 6.5 = 617$ cu. ft., but it will be better to leave it at seven ft., the same as with Plant No. 1 stills.

D.—According to Table 11, flow line to be 3.3 ft. from top of still. Since still selected is 14 ft. high and not 13.3, flow-line should be four ft. from top of still, giving the required 10-ft. liquid depth.

E.—Flow-line to be 6-in. instead of 4-in. diameter as used in Plant No. 1 stills.

F.—There are four possible means for mechanical agitation that may be used separately or two or more in combination: (1) Turbo-Mixer; (2) For each still an outside pump recirculating system; (3) Internal reflux; (4) Plant No. 1 still type.

All are effective to a more or less extent. Obviously, selections should be made on basis of experience if possible; on first, operating, and maintenance costs; and on general practicability for meeting local conditions of job in hand.

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Fig. 1. Close-up of pipe, showing segregation of pits on lower half of line.

Half-Soling A Pipe Line

By

ELTON STERRETT

PITTED as though by smallpox, the main line exposed by digging a test hole at milepost 14-18 showed corrosion much worse than anticipated after only four years in service. The 8-in. seamless, 0.32 carbon steel tube was found to be eaten away in spots to less than half its original wall thickness, and the knife blade used for probing one deeply corroded spot even brought a show of oil.

As there had been nothing in the preliminary survey to indicate a "hot spot" through the marsh traversed by the right-of-way at this point, this section had received nothing more than the hot coating accorded the remainder of the line on the job before being lowered into the trench. But, on the strength of the test-hole evidence, the line was stripped both ways until the aggravated condition was entirely exposed, and the line at each end of the trench again carried only such superficial corrosion as had been encountered in others of the test pits dug in what had been expected to be merely a routine examination.

The line was being operated full-time and to capacity, and to replace the several hundred feet in the corroded section would have involved either pumping water 40 miles from the main line station to blank off the damaged portion; or, the trouble showing up where the line sagged to traverse a low-lying swamp, replacement would have involved the draining off and temporary storage of several hundred barrels of crude while the new part was being welded in.

Even accepting the loss through shutting down for replacing the damaged section, there remained the unwelcome prospect of repetition of the work at frequent intervals during the life of the pipe line, with the marshy section a constant menace to operation.

As the work of stripping and examining the corroded metal continued, it became apparent that nine-tenths of the pits occurred on the lower semi-circumference of the pipe. This fact led the superintendent to plan a unique half-soling of his line, keeping it in service throughout the repair and, he believes, forestalling a recurrence of the trouble during the probable usefulness of the line.

Using a portable electric arc-welding outfit, the pits were first filled, care being taken to see that the built-up metal on

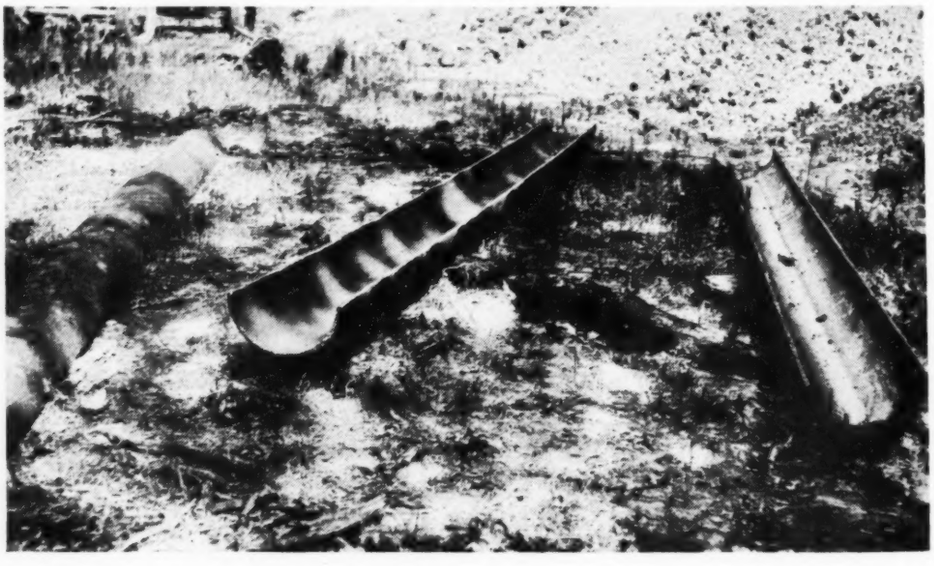

Fig. 2. Sections of the "half sole," the one at the right coated and ready for applying. Note how coating is stopped off to leave edge clear for welding.

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Fig. 3. View of repair with first welding completed, showing alternation of earth and timber supports.

the lower portion of the pipe did not project more than a tenth of an inch beyond the pipe contour. Then, by hand a liberal coating of corrosion-resistant material (No-Oxid) was applied over the lower portion of the pipe, and each section of "half sole" clamped tightly up in place and arc-welded to the line pipe throughout its length and across each end.

This "half sole" was formed by splitting 9⅝-in. casing longitudinally with an oxy-acetylene torch and lining the halves inside with carefully applied coatings of No-Oxid. As the inside diameter of the casing exceeded the outside diameter of the line pipe by only about three-tenths of an inch, the neutralizing agent practically filled the 0.15-in. space and sealed the high-carbon metal of the original pipe against further corrosion.

When stripping the line, care was taken to leave solid earth supports, so spaced that the line was carried in short spans, allowing the affixing of alternate sections of the "half sole" without changing the location of the line in the least. These first sections welded in place, heavy shoring blocks were driven under them so that the line would still remain undisturbed while the remaining earth pillars were cut away to permit completing the repair.

Planned and executed in this manner, there was no chance of strain, distortion, or the possibility of introducing nodes for crystallization, as must have been the case had the line been stripped back and hoisted out so that the work might be done above ground. One joint of "half sole" was intentionally omitted, to provide a check piece on which further corrosion might be compared with that on the repair.

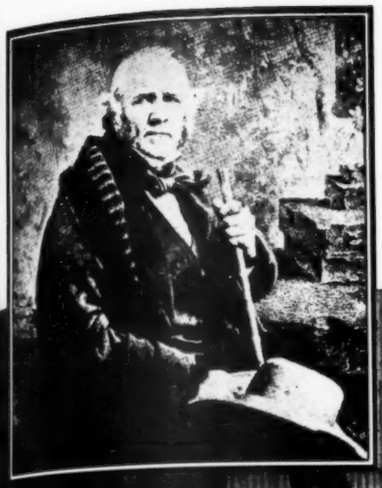
After welding was completed, the entire line was coated with the neutral agent, wrapped with tar paper, and given a hot coat finish, to seal as well as possible against the reintroduction of trouble.

Whether regarded as electrolysis or as corrosion brought about by salt and other chemicals carried in the soil, the addition of and practical doubling of the thickness of the metal along the danger zone of the line should give adequate protection for either cause. The writer inclines toward the corrosion hypothesis, as the pits on the bottom of the pipe would occur where the liquid would naturally be concentrated, while electrolysis should be most pronounced at the top and sides, where the earth was in closest contact with the metal of the pipe.

When the job was completed, to balance the increased expense of welding the "half sole" in place, there was the saving effected by avoiding a line shut-down, and the gain in purchasing the 9⅝-in. casing for only half the length of the section needing repair—each joint of casing forming two "soles" when split—whereas line pipe for the entire distance would have been required had simple replacement been made.

An intresting detail cropped up in procuring pictures of the work. As the pits were on the under side of the pipe, and the upper half brightly illuminated by sunlight, it appeared that the pit pictures would be difficult or impossible to obtain. By utilizing the electric arc making the repair, however, this difficulty was surmounted. An arc was struck, as close as possible behind the focussed camera, and after the sputtering light had steadied, the shutter tripped, due allowance being made in timing and aperture for the quality of light produced.

Fig. 4. Close-up showing a filled pit on the pipe at "a," and the double bead "b" of weld at junction of "half-sole" and line pipe.



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The Texas well shown here is J. E. Crosbie's Pitt No. 7, near Borger, Texas, Warren & Robinson, contractors. The men are, left to right: E. L. Tucker, tool dresser; S. D. Drake, Jarecki Mfg. Co.; Bob Warren, Prod. Supt., J. E. Crosbie, Inc.; Bert Robinson, Warren & Robinson; Vern Moses, driller; Ed Garrett, driller; Bill Wray, tool dresser; W. B. Hasenfuss, Union Wire Rope Corp.

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A Recent Metallurgical Development of Interest

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Hard-Facing Oilfield Drilling Bits with Metallic Boride Crystals

UNDOUBTEDLY, the most startling development since oilfield drilling bits were first hard-faced is the wear-resisting preparation now possible with the introduction of metallic boride crystals. These crystals, which are the result of four years of extensive research and development, have unusual properties that permit a kind of oilfield drilling bit processing that has heretofore been impractical.

Metallic boride crystals have physical and chemical characteristics quite unlike tungsten carbide and can be utilized in a wide variety of shapes and products. They have a hardness of approximately 9 on Moh's scale, a very high melting point, and they do not oxidize at elevated temperatures; consequently, when subjected to welding heats these crystals do not fuse with each other to form a solid mass and do not break down or disintegrate. No oxide or slag is forced into the parent metal when they are used.

Under the trade name of "Colmonoy", metallic boride crystals are prepared in a finely-divided crystalline powder known as "Sweat-On." They are bound together with a small amount of binder metal and cast into shapes or inserts of the proper size to be used in a fabrication of oilfield drilling bits. They may be had in the form of granules of various sizes, and compounded with varying amounts and kinds of base metals, they are furnished as welding rods and electrodes.

•

To sink these metallic boride crystal inserts into a drilling bit it is necessary to heat the bit to form a puddle of fluid metal in which the insert can be sunk to any desired depth

To fabricate an oilfield drilling bit with these metallic boride crystal products the procedure is quite different from that employed with ordinary tungsten carbide and other types of hard-facing materials.

In the first place, there need be no fear of oxidation. Instead of forming a matrix with the deposit from welding rods or electrodes to imbed the inserts, the parent metal of the bit is heated to form a fluid puddle where the insert is to be placed and the insert is sunk in the molten metal to any desired depth. By this method it is easy and eco-

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nomical to reinforce the cutting faces of drilling bits where and with as many inserts as is desired. Further than that, these metallic boride inserts so applied form a bond or amalgamate with the parent metal, insuring that they can not be loosened up or knocked out of place when the bit is in use.

After sufficient inserts have been placed, it is advisable to cover the surfaces of the bit that are exposed to the most wear with either "Granules" or "Sweat-On." This is done by spreading the granules or Sweat-On over the surface to be processed and applying the heat of oxy-acetylene torch sufficiently long to sink the granules or Sweat-On into the surface of the parent metal.

Metallic boride crystal inserts can be utilized as a welding rod and fused down to form a hard wear-resisting overlay on the land side of the cutting edges that increases the bit's effectiveness as well as serving to hold the bit to gauge

Then, as a further reinforcement, long metallic boride inserts should be used as a welding rod and melted down with the heat of the oxy-acetylene torch to form a deposit of highly abrasive resistant metal along the lands of the cutting edges. This application insures that the bit will do its work more effectively and at the same time hold its gauge.

Bits fabricated by this described method may be heat-treated without affecting the inserts or the wear-resistant overlay in any way. These metallic boride crystals do not lose either their identity or their effectiveness when the parent metal is heat-treated or, for that matter, heated up and forged. Carbonizing, should it be necessary, must be done before the "Sweat-On" or granules are applied but heat treatment for strength, that is a quench and a draw, should follow their application.

Comparisons, of course, are often misleading and do not always prove anything, but metallic boride crystals differ from tungsten carbide in many ways. In the first place, they are considerably lighter, their specific gravity being approximately 6.45 as compared with 16.00 for average tungsten carbide. They are hard, as hard if not harder than tungsten carbide, and have a chemical effect upon any binder base material used with them so that the physical properties of that base material will be changed and it will be much harder, much tougher and more acid-resisting and wear-resisting than in its natural state. The metallic boride crystals themselves remain unchanged.

For those who are metallurgically inquisitive, metallic boride crystals, as they are made by Colmonoy, Incorporated, are a decidedly new product, incorporating a new line of thought and a new line of development. They cannot be made by the heat of the electric arc and are the result of the heat of chemical reaction. They are insoluble in practically all acids, including aqua regia and a mixture of hydrofluoric and nitric acids, and have a hardness and wear-resistance that rivals the diamond. Along with these properties, Colmonoy metallic boride crystals have a decided hardening and acid-resisting effect upon fused metals with which they come in contact.

Here are shown metallic boride crystal inserts in various sizes and lengths for oilfield drilling bit fabrication

Metallic boride crystal granules and Sweat-On. Either forms an unusually efficient wear-resistant protection for oilfield drilling tools

Petroleum Industry Searching for Oil Source

Man is still seeking the origin of oil, industrial lifeblood of today's machine age. Under the sponsorship of the American Petroleum Institute, the search for oil sources begun several years ago is being continued with the coöperation of scientific organizations, domestic and foreign government bureaus, and individuals.

Scientific research is being employed in seeking the source of oil where once the "wildcatter," or oil prospector, gambled by drilling undeveloped territory. It is believed that with further progress it will be possible to ascertain not only the sources of oil, but also to determine in what regions the chance of discovering hidden subterranean oil pools is greatest.

In the light of present knowledge, structure, sand, and source are requisites to an oil pool. Productive pools have been found on poor structure, and even treacherous sand conditions have yielded substantially, yet many wells have been drilled where both structure and sand conditions were favorable, but oil was lacking. Deficient source now is believed to explain the failure of the Tomball field on the Gulf Coast, of the Wheeler Ridge field in California, and of other fields, to produce satisfactorily despite favorable indications.

The research work in oil sources now is considered of vital importance not only in the search for new oil areas and fields, but also in connection with other studies, such as the migration of oil underground. While sporadic work has been done in studying migration, particularly as to how far and how rapidly oil can move through porous sands and rocks, definite conclusions cannot be reached until the origin of oil is known.

Under the direction of Dr. Parker D. Trask, of the U. S. Geological Survey, Washington, D. C., the Institute's research project began with a study of the oil-forming ability of the muds and sands of ocean bottoms. Virtually all known oil fields are in, or associated with, rocks that once were such muds and sands. In this study Dr. Trask and those coöperating with him analyzed samples of mud and sand taken from the bottom of the Seven Seas.

The second stage of the work, now in progress, involves collecting and studying the formations associated with known oil fields, the knowledge gained in the first stage being applied in the second. While those engaged in the task say that possibly five years remain before thorough understanding is reached and the origin and sources of oil are known exactly, the work of the past three years has narrowed steadily the broad field of theories as to the origin of oil. Each newly-discovered fact has been a direction marker pointing the course of new research.

Results obtained already have proved useful, and the work is seen as entering the stage where each year's findings not only will add to man's knowledge of the origins and sources of oil, but will be of material aid in solving many of the petroleum industry's production problems.

University of Calfornia Offers Revised Course in Diesel Engineering

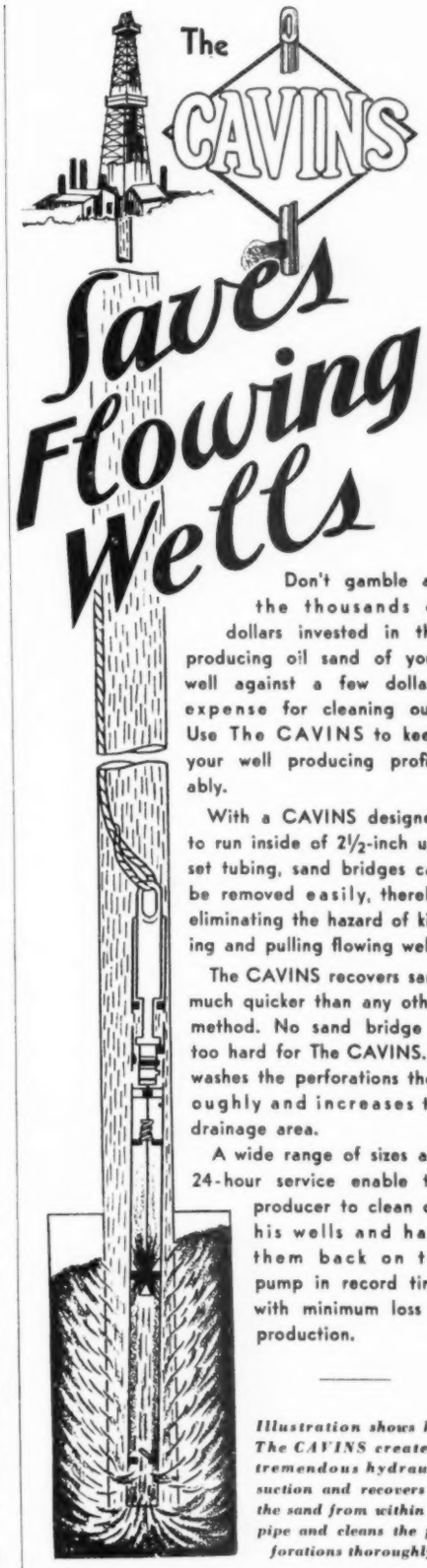
Announcement has just been made by the Extension Division of the University of California, Berkeley, California, that their course in Diesel engineering has been thoroughly revised and is now open for those who wish to enroll. The course presents a general discussion of the elements of the Diesel engine so as to furnish the practical man with fundamental principles that will assist him in the operation and maintenance of the engine.

Development of the engine within the past few years has progressed rapidly from the low-speed to the high-speed type. The wide demand has speeded production until we find all industries affected by this apparently new form of power generation. The revised course has been laid out to cover numerous recent subjects. A few of the important points covered are: principles and theory of the Diesel engine, types, two- and four-stroke cycle engines, supercharging, precombustion and auxiliary air chamber engines, turbulence, Hesselman engines, fuels, various principles involved in fuel pumps and fuel injectors, timing, governors, opposed piston engines, Diesel-electric rail-cars, materials, high-speed engines, torsional vibration, construction features, cooling and lubricating oil systems, starting and reversing systems, auxiliary equipment, operation, maintenance, and repairs.

Each assignment is fully illustrated by diagrams and blueprints.

The required fee for the course is $7.00 for students in California, or $10 for those enrolling from points outside California.

For further details one should consult the University of California Extension Division, 301 California Hall, Berkeley, California.



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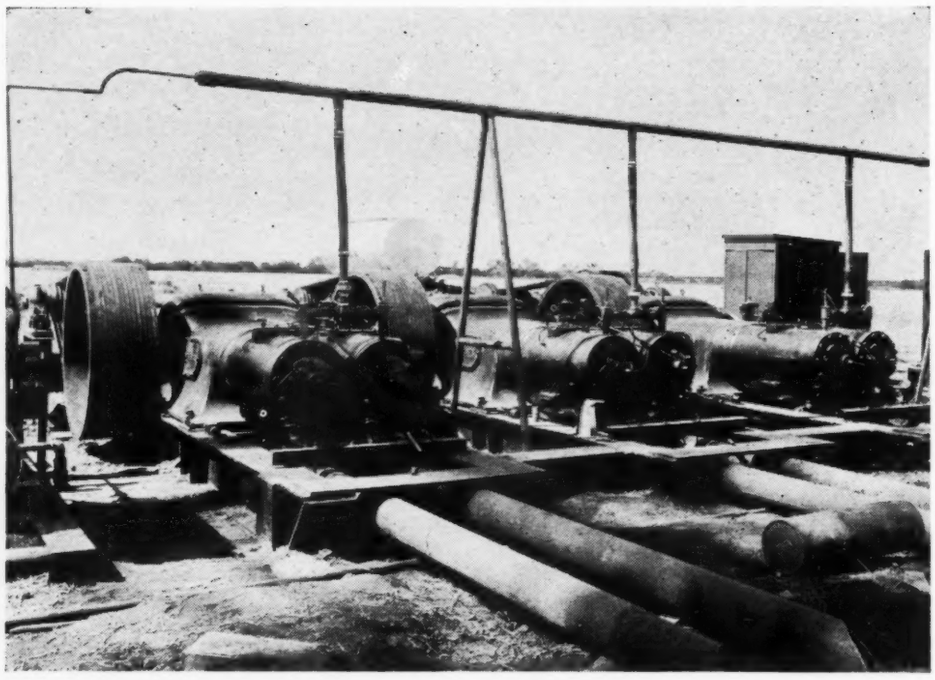

Fig. 1. Rear view of power plant showing details of setting of engines.

By

W. C. LANE

Generating Plant for Driving A-C. Drilling Rig

MANY wells have been drilled with both d-c. and a-c. powered rigs so that the characteristics and load limits of each type of drive are now well known. As a rule when energy for either type of drive is taken from a power line no attention is paid to the possible effect of the voltage disturbances incident to drilling work. On the d-c. rigs the differential fields of the generators act in such a way that excessive load peaks are eliminated and none reaches the source of the energy supply. In designing the existing a-c. rigs no attempt has been made to eliminate these disturbances, the current practice being to depend on the large generator capacity back of the line to minimize their effect. When a-c. energy is procured from a plant of limited capacity, however, this factor cannot be ignored.

At this time the a-c. drives in service probably outnumber those operated by d-c. in the ratio of 15 to 1. Though the merits of d-c. energy were recognized long before it was proposed to utilize electrical energy for drilling, it was not used to any great extent until about two years ago. The reason for this is that no one as yet has been able to develop a method whereby d-c. energy can be transmitted at a high voltage and utilized at the end of the line. The copper losses in a low-voltage system of any great length are excessive. With the introduction of light internal combustion engines of the required capacity and reliability it became possible to generate power near the wells to be drilled and thus eliminate the transmission difficulties.

It did not take long for d-c. rigs to establish their worth, especially on wildcat work in localities where water and fuel are major items of expense. Owners of a-c. equipment have not been slow in recognizing the advantages of a rig that is complete within itself, requires a nominal amount of good water, operates on eight or nine barrels of fuel oil per day and is independent of power lines. They are familiar with the characteristics of their a-c. motors and many have been wondering whether it is feasible to assemble portable a-c. generating plants to drive them.

As far as the writer has been able to learn, there are seven a-c. rigs in operation in the Mid-Continent but there may be other rigs. The plant problem appears to be one involving the coördination of the power demands of the particular drive to be operated with that of the generator and engine capacities.

While not absolutely necessary, it appears that much annoyance will be eliminated, especially on rigs that are over-motored with respect to the generating plants if a load-limiting device (not a circuit breaker) is added to the control of the hoisting motor. Numerous inspections have shown that it is the custom to set circuit breakers to operate at such a high load that they are useless as a load-limiting device. The reason for this practice is that drillers are afraid the opening of a breaker will cause them to drop a string of pipe. It is a simple matter to add a contactor and a resistor to an ordinary controller and arrange it so that resistance will be added to the rotor circuit when a certain load is reached. The effect of this will be to reduce the speed of the motor but the torque will remain practically constant. Obviously the result of this action will be to relieve the engines in the plant without interrupting the service.

Just now the engines and generators on the rigs in service are arranged in three different ways with respect to one another. The method in use on the first of the six to be put in service is one that is in general use in stationary power

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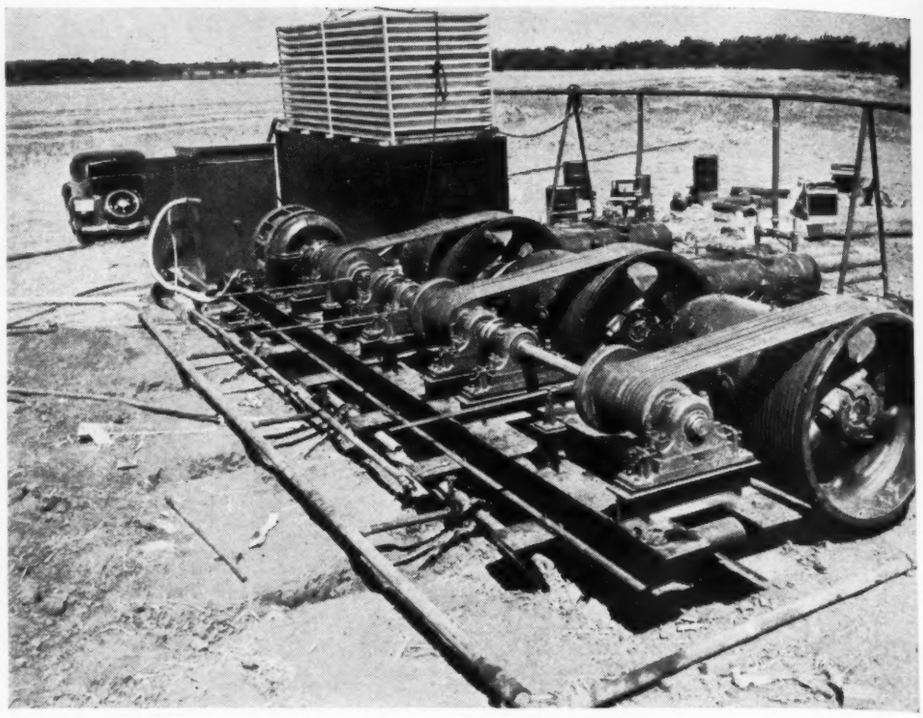

Fig. 2. General view of power plant with cooling tower and electric control panel in background.

plants. Two or more units are provided, each of which includes an engine and a generator. During periods of heavy load all the generators may be operated in parallel on the common load and when the load is light superfluous units are shut down. At such times repairs and adjustments to engine and generators may be made. Some engine manufacturers question the reliability of this method when applied to the light, high-speed engines used on portable work and refuse to recommend it.

Their hesitancy is due to the possibility of a hunting action being set up among the engines and generators that will cause an interruption of service. Engines on units to be operated in parallel should be so designed and adjusted that they will respond to a load change with an equal degree of alacrity. Unless they do this they will not only share the useful load unequally but will cause some generators to run a trifle slower than others. As a result certain generators will be operated as motors and others as generators. In attempting to stabilize things the governors set up a see-sawing action that may cause the generators to drop out of synchronism and open the circuit breaker.

In spite of the pessimism of some of the engine manufacturers the method has been used successfully on two or three rigs and is in use every day in numerous stationary plants. It is suspected that where the selection of the apparatus going into a plant is based on certified characteristic curves and their coördination rather than on the abstract merits of each piece of apparatus considered alone the fears of these manufacturers will be found to be groundless.

As far as operating difficulties are concerned the simplest plant to operate includes one large engine and a generator of ample capacity. This arrangement is simple to install, synchronizing troubles are eliminated and slight variations of engine speed are of no importance. As one will suspect, the chief objection to be voiced is that there is no reserve.

The records of numerous generators of the type used indicate clearly that they can be driven continuously for months at a time if necessary. Interruptions of service due to generator trouble should be regarded as inexcusable. As insurance against engine trouble, one contractor having rigs of this type has provided a 150-hp. 125-kva. reserve unit for use in case the main engine must be shut down for repairs. The small unit is used on the cable tool work when wells are not completed with the rotary.

The third combination introduced recently is similar to the second one mentioned with the exception that a plurality of engines are used to drive the one generator. One such plant has been assembled by the Noble Drilling Company, and has been used to supply energy for the rotary work on a well drilled for the Watchorn Oil and Gas Company near Arkansas City, Kansas.

The plant was designed to carry a 150-hp. drawworks motor and a 200-hp. mud pump load. It includes a 375-kva. 480-volt, 3-phase, 60-cycle, 1200-r.p.m. generator, with directed-connected exciter coupled to a line shaft. The shaft is arranged so that it may be driven by one, two, or three 14 x 18, 300-r.p.m. horizontal twin-cylinder Fairbanks-Morse Continental Semi-Diesel engines. When operated on oil the engines are guaranteed to deliver 150 hp. continuously and 250 hp. peak loads. On gas their ratings are 170 and 250 hp. respectively.

The engines are shown in Fig. 1. It will be observed that they are mounted on substantial steel bases and that provisions are made for sliding them on these bases as a means for adjusting the tension in the V-belts. The sheaves are extra heavy thus providing the necessary flywheel effect and are arranged for using turning bars.

With the exception of the couplings, the equipment constituting the line shaft assembly was manufactured by the Dodge Company. An idea of the plant as a whole and of the details of the line shaft assembly can be obtained from Fig. 2. The shaft itself is composed of three segments connected together and to the generator by Falk flexible couplings. A 12-in. grooved friction disc clutch sheave is mounted on each shaft section, so that when an engine is idle its drive is at rest. The entire assembly, together with the generator, is mounted on a fabricated steel structure and in moving the plant, it is transported as one piece.

The voltage of the generator is controlled by a carbon pile regulator. The regulator, an oil switch, and the customary instrument and circuit breaker actuating transformers are mounted in an outdoor type steel cubicle. This is shown in Fig. 2. All auxiliaries are mounted together on a common base as shown in Fig. 3. They include a d-c. lighting generator, a rotary wash-down pump and an air compressor with the necessary storage tanks. All are driven by a 10-hp. full Diesel engine.

Obviously, the feature of unusual interest in this plant is the use of three engines of the type chosen. The combined cost of the three is less than that of a single engine having a capacity equivalent to their total continuous rating. The flexibility of three engines is such that they can be operated at a high efficiency at all times. In case it should be desired to apply them to other work a 150-hp. engine is a convenient size to use on a heavy bandwheel power, in a compressor

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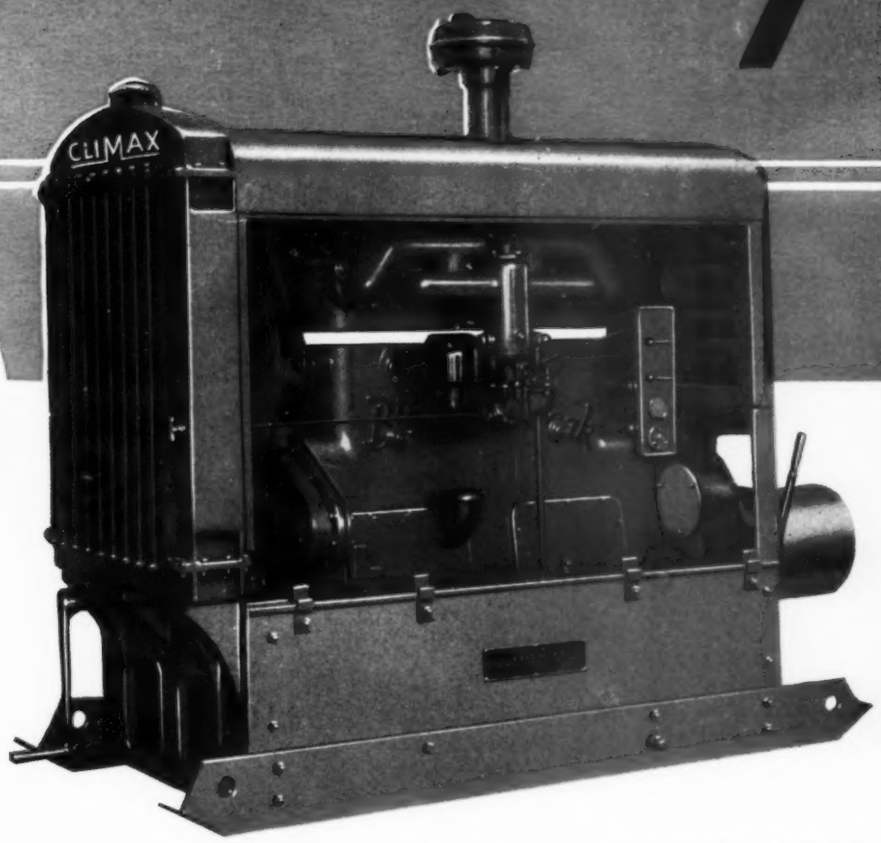

We are pleased to announce our appointment as exclusive distributor in the Mid-Continent field for the Climax Engineering Company, of Clinton, Iowa, manufacturers of Climax Blue Streak Engines and Power Units; also Chrysler Industrial Power Units, Climax equipped.

Climax Engines are well-known for their extraordinary ability to stand up in oil country service.

Complete Units of various sizes, both Blue Streak and Chrysler Climax, are stocked in centralized locations in Texas, Oklahoma and Kansas.

Parts service is provided from well located stocks throughout the Mid-Continent area.

Above Climax Blue Streak Model N-4-B, 75 HP, is a typical Power Unit available in this line from 20 to 200 HP, for pumping, drilling and other oil field service.

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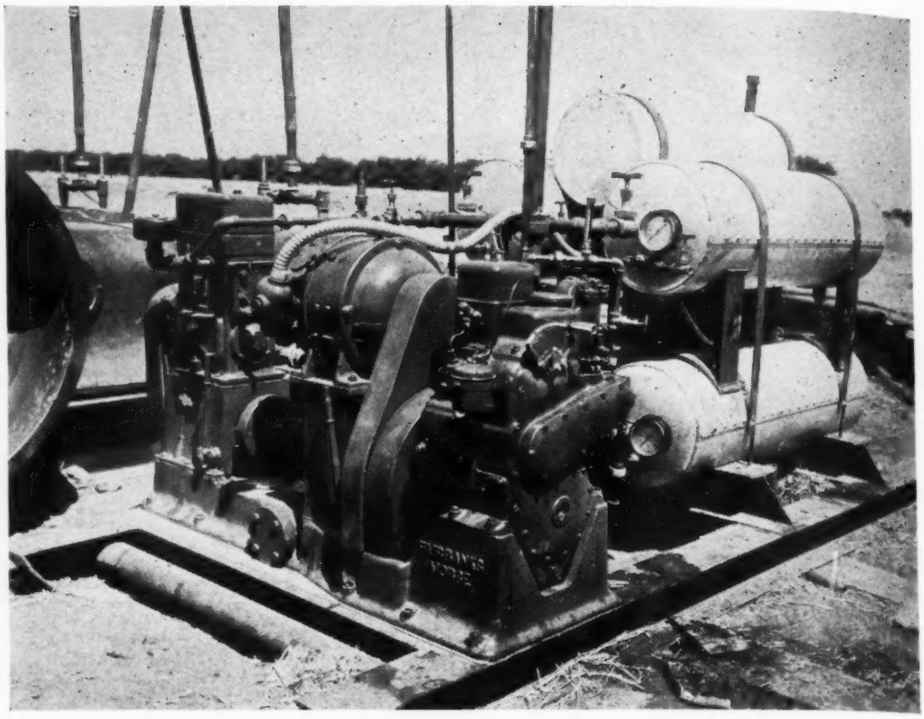


Fig. 3. Unit assembly of auxiliaries used with plant.

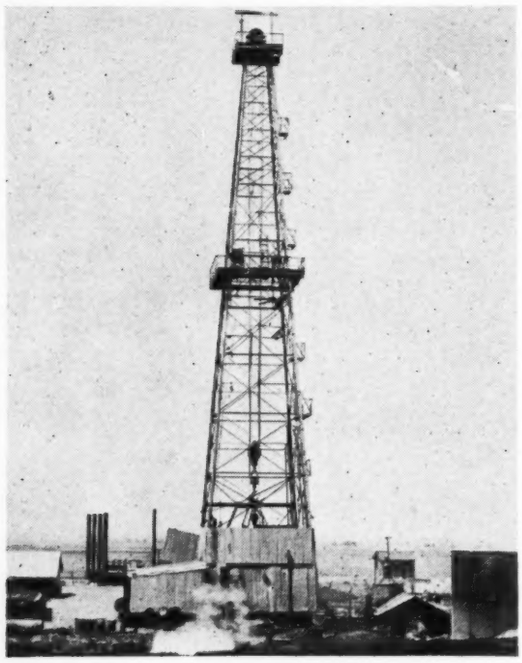
station, or on a small electrified oil lease.

Designers of d-c. plants have established the principle that it is the slush pump and not the drawworks motor that determines the capacity of the plant. Calculations based on the maximum probable power such a rig will consume while drilling show that the three engines have ample capacity for the greatest continuous load the pump motor will be able to carry and the drilling motor will be required to carry.

The maximum load a drawworks motor of this type can carry just before it breaks down is approximately 425 hp. Assuming a combined generator and motor efficiency of 75 percent, it works out that each of the three engines will be required to carry a 190-hp. load during the short periods the motor is taxed to its limit.

Doubtless contractors and others who have been using a.c. for drilling have fairly definite ideas regarding the type and depth of the wells they should try to drill with the rigs they have on hand. From what has been said it appears that the plant described above has ample capacity for the 150-hp. drawworks drive and a 200-hp. mud-pump load. The owner of this rig believes that wells up to 4000 ft. may be drilled with it without difficulty and within an economical period of time. By taxing the three engines to their limit it appears that the plant will have ample capacity for a 200-hp. drawworks motor.

Union Oil Sets Heaviest String of Casing



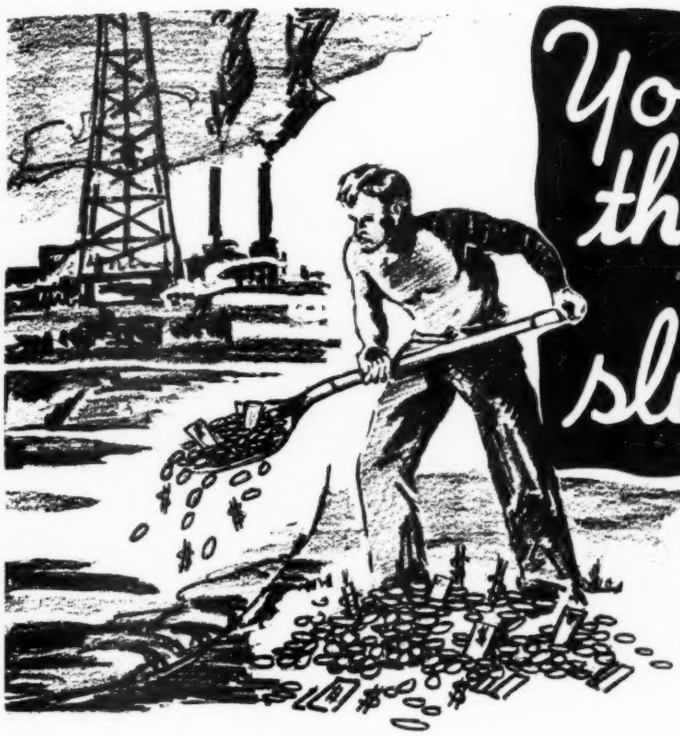
Lillis Welch No. 1

DURING the month of July, the heaviest string of casing ever set in any well drilled in California, and the longest string of comparable size ever set in any part of the world, was run in and cemented off by the Union Oil Company. This occurred in the Lillis Welch No. 1 well, which is being redrilled by the company under contract with the North Kettleman Oil and Gas Company, and which is located in the northwesterly portion of Kettleman Hills about two and a half miles northwest of the Union Oil Company's Amerada lease.

After a number of unsuccessful attempts to redrill the well, the company removed the original 7-in. casing and resumed work from the end of the 11¾-in. casing at 6710 feet. In drilling ahead, there arose the difficulty of keeping such a large amount of open wall in condition, so, upon reaching 9085 ft., 8⅝-in. casing was set to 9081 feet.

This record string weighs 36 lb. to the foot. Standard casing and couplings were used, with the exception of the last 2900 ft., which is special, high-tensile strength casing with thin couplings. The total weight from grass roots to bottom is 326,916 lb.—about the weight of a passenger locomotive and tender.

At present writing the well is being drilled ahead below 9200 ft., and it is planned to set 6⅝-in. casing to about 10,900 feet. If successful, the weight of this string will exceed 305,000 pounds.



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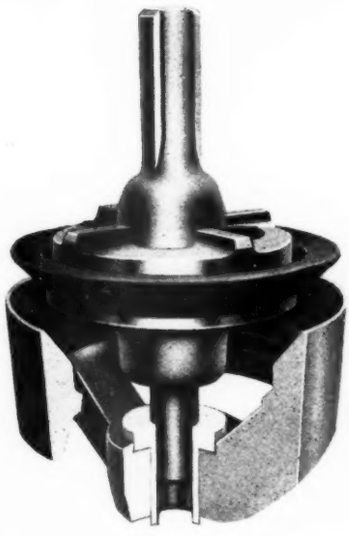

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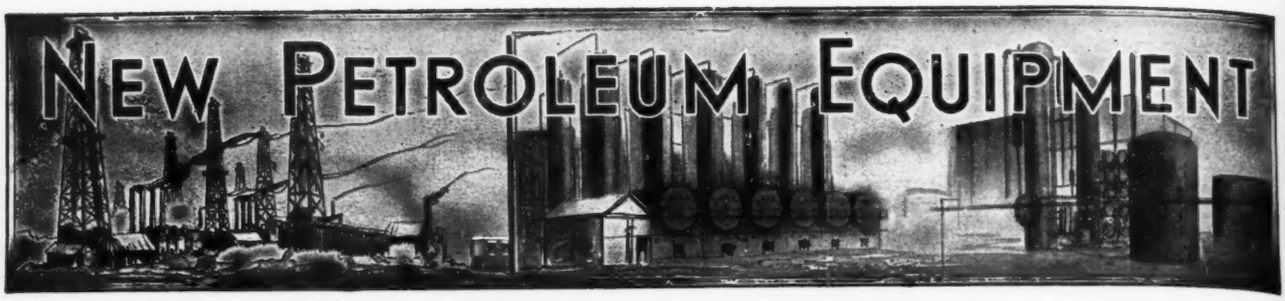
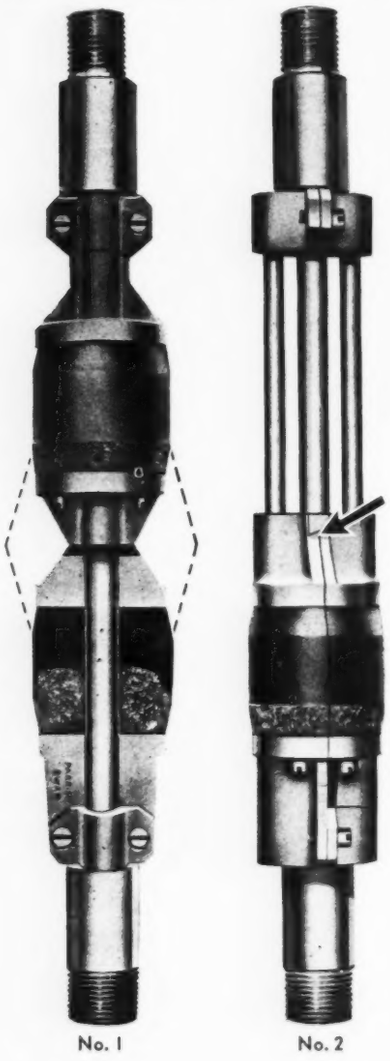


Parrish Valveless Swab

THE Parrish Tool Corporation, 1214 South Haskell, Dallas, Texas, announces the Parrish Valveless Swab. The swab is split in half, one-half slidable. The manufacturers claim it cannot foul from foreign matter in the hole, and that it will by-pass larger quantities of fluid, thereby permitting the swab to drop faster and make more trips per hour. It is of bronze construction, with the rubber moulded of a special oil-resisting compound reinforced in the lower part to equalize the load and insure uniform wear. Guide rods prevent parts from twisting or fouling, it is stated, and guide rod sleeves prevent the rubber from packing on the guide rods and act as an automatic stop so packing will not pass its elastic limit and shear off.



No. 1—Swab with slidable part open.

No. 2—Swab with halves together.

Armstrong Enters Detachable Socket Wrench Field

ARMSTRONG Bros. Tool Company, Chicago, announces a complete line of Chrome-Vanadium Steel Sockets for detachable head socket wrenches. These new sockets come in all sizes and types from the tiny $\frac{3}{32}$-in. miniatures for fine electrical work to the 2½-in. extra heavy-duty sockets. Included in this new line are both double-hex (12 point) and double square (8 point) sockets, sockets for miniature, light, standard, heavy duty, and extra heavy duty drivers.

The sockets are chrome-plated and come singly or in matched sets made up for all industrial, electrical, and automotive uses. Sets come in fitted steel cases.

Internal Valve for Bulk Storage Tanks

Among new equipment recently announced for bulk storage tanks is a new internal valve introduced by Shand & Jurs Company of Berkeley, California, in response to a demand for an internal valve that would protect the contents of bulk tanks from fire during business hours and theft at night.

This new S. & J. product consists of a heavy bronze body with large ports that afford full flow. A spring-loaded valve with metal to metal seat is opened by the action of a steel handle shaft on roller bearing lifter.

In the event of fire during operating hours, the parting of a fusible link automatically closes the valve, and at night it is closed manually and locked with a padlock.

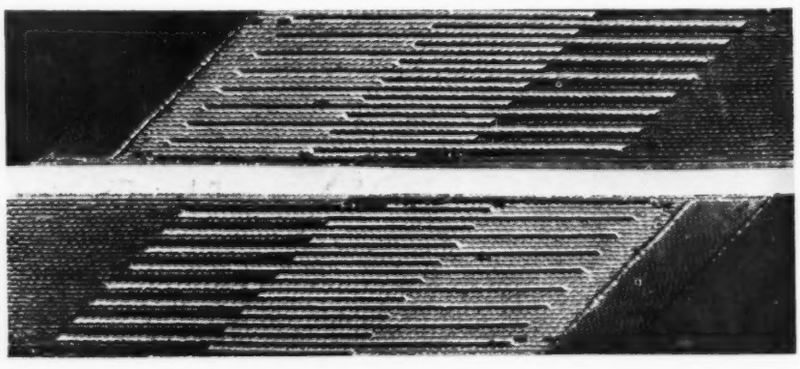
Vulcanized Splice for Compass Cord Belt

ANNOUNCEMENT of a patented vulcanized splice for the well-known Compass Cord transmisson belt was made recently by The Goodyear Tire and Rubber Company, Akron, Ohio.

By means of this new vulcanizing method, Goodyear Compass Cord belts now can be made endless on the drive. This development enables belt users to obtain Compass Cord belting in roll-lot, non-endless lengths for use on belt drives where it formerly was necessary to dismantle the pulleys to install an endless belt.

The ends of the Compass belt are joined together by dovetailing the load-carrying core of cords at the splice and by vulcanizing the spliced portion of the belt with a portable vulcanizer developed for this purpose. The Compass Cord belt is so constructed that the load is carried entirely by a layer of cords, laid side by side, embedded in rubber, and sheathed in a protecting fabric envelope.

For belt drives where endless belts can be easily and quickly installed, Goodyear will continue the manufacture of Compass Cord Endless belts, it is announced.



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This engine with the resumption of cable tool drilling has had an unusually wide acceptance.

Good Drilling Motion—Operating with Standard Rigs with countershaft and reverse clutch transmissions and with Machines, its Drilling Motion is consistently satisfactory.

Powerful—Developing approximately 200 Horsepower at top speed, it is capable of pulling tools and bailers at the fastest possible speeds desired, and is one of the most powerful cable tools engines available.

Flexible—Speed range from 125 r.p.m. to 500 r.p.m. permits slowest required drilling speed with high top bandwheel speed.

Sturdy—Engine of heavy duty type—running at slow speeds results in long life.

Simplicity—This type of engine with a very simple oil injection system is easily understood by drillers and tool dressers.

Mounting—It is mounted on heavy steel sub-base with air filter — circulating pump and fuel system mounted and assembled on same base — *within required road clearance.* If desired, base can be extended for mounting reverse countershaft or reverse clutch, V-Belt driven from engine.

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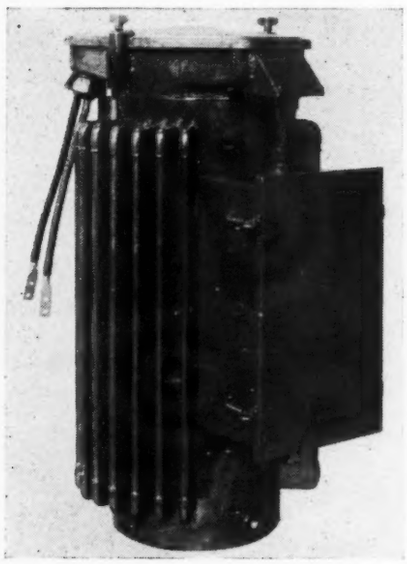
Three G-E Voltage Regulators

THREE new automatic voltage regulators, developed for use on branch feeders and for sections of long feeders, have been introduced by the General Electric Company, Schenectady, New York, as supplements to its present line of induction and step voltage regulators. Of the three new devices, one is an induction regulator, one a step regulator, and the third a step voltage booster.

NEW INDUCTION REGULATOR

The new branch-feeder induction voltage regulator is designed to provide, at low capital investment, efficient and automatic regulation of branch and rural lines, within limits ranging from a 10 per cent boost to a 10 per cent lower. It is applicable where the smooth regulation obtainable only with an induction-type regulator is desired but where load conditions do not justify the installation of conventional station-type regulators.



Induction voltage regulator, 24 kva. for pole mounting, with panel casing

This regulator operates in exactly the same manner as a conventional station-type induction regulator but, being designed for pole-mounting, requires no land purchase or foundation expense. Its control panel, contained in a weatherproof case, may be mounted either at the base of the pole or assembled on the tank of the regulator. Either automatic or manual operation can be obtained by means of turn-button switches mounted on this panel. The regulator is built in 12- and 24-kva. sizes for 2400-volt, 50- and 100-ampere, and 4800-volt, 25- and 50-ampere 60-cycle circuits.

NEW STEP REGULATOR

The new branch-feeder step voltage regulator is low in cost, small in size, and suitable for pole-mounting. It provides four steps of two and one-half per cent each, which can be arranged for all boost, all lower, or any combination of boost and lower, within the 10 per cent total range. Because of this flexibility, the regulator is applicable to circuits that may require a combination of boost and lower and which, though not requiring the smooth regulation of an induction regulator, should have a regulation as close as two and one-half per cent.

The design and method of operation permit the use of a simple and reliable switch-and-mechanism unit. The device is controlled by a contact-making voltmeter acting in conjunction with a motor-relay switch. Through reduction gears, a motor stretches two springs which, when released, pull a moving contact from one position to another at high speed. During the momentary switching interval, the load current is carried by a Thyrite by-pass, providing continuity of service. The voltmeter, protected by a strong, moisture-proof case, is of the same type used in G-E station-type regulators, and the motor-relay switch is simply and strongly constructed to assure sustained, reliable service.

The control equipment, enclosed in a weather-proof cabinet, may be mounted either on the tank or at the base of the pole. By means of turn-button switches, the voltmeter can be disconnected and the regulator operated by manual control of the motor. A plainly visible dial mounted on the outside of the tank, shows clearly the operating position of the regulator at any time.

The regulator is available in 5-, 10-, 15-, and 25-kva. sizes, for 2400- and 4800-volt, 60-cycle circuits, 70 amperes or less.

NEW STEP VOLTAGE BOOSTER

The new branch-feeder step voltage booster provides a single definite boost in feeder voltage when required by periodic heavy demands from domestic cooking and lighting peaks, or factory-lighting loads. Because of its small size and low cost, it is suitable for use on single-phase rural circuits and lightly loaded branch circuits for which the use of higher-priced regulators cannot be economically justified.

Whenever the voltage on a circuit drops below a pre-determined level the booster automatically provides a single boost of either two and one-half, five, seven and one-half, or ten per cent. Then, should the voltage exceed a predetermined upper level the booster returns to a neutral position and remains there until the voltage again drops below the lower limit.

As the tapped portion of the winding has four two and one-half per cent sections, the booster can also be connected to provide: (1) a two and one-half per cent continuous rise and a two and one-half, five or seven and one-half per cent automatic boost; (2) or a five per cent continuous rise and a two and one-half or five per cent automatic boost; (3) or a seven and one-half per cent continuous rise and a two and one-half per cent automatic boost. In addition the winding can be connected to lower the voltage, instead of boost it; or to provide any combination of continuous lower and single automatic boost, or vice versa, within the range of the four two and one-half per cent sections of the tapped winding.

Switching from the neutral to the boost position is instantly effected by a double-throw contactor actuated by a resonant voltage relay. Magnetic blow-out coils on the contactor afford quick interruption of the circuit, prolonging the life of the contacts. During switching, the load current is carried by a Thyrite by-pass similar to that used on the new G-E branch-feeder step regulator.

The booster is designed for 2400-volt, 60-cycle circuits of 70 amperes or less, and is available in five ratings of 1.5, 3.0, 5.0, 10.0, and 15.0 kva.

Light-Weight Refractory Concrete

A NEW TYPE of Firecrete for casting light-weight refractory concrete on the job has been announced by Johns-Manville, 22 East 40th Street, New York City. Known as L. W. (or Light-Weight) Firecrete, this new product is composed chiefly of high alumina clay calcined at high temperatures. The resulting concrete weighs only 75 lb. per cu. foot. Under continuous operation at 2400 deg. fahr.,

This L. W. Firecrete panel, easily lifted by J. L. Miller of the J-M Research Laboratories, measures 4½ in. x 24 in x 32 in. The large face had been maintained at a temperature of 2500 deg. fahr. continuously for 24 hours, then subjected to a blast of cold air immediately after the burner was turned off. Panel was tested in U. S. Navy Simulative Service type furnace shown in immediate background.

shrinkage is so slight as to be entirely negligible. It has withstood the most severe alternate heating and cooling tests without spalling, the manufacturers state.

L. W. Firecrete is 40 per cent lighter than fire brick and has 40 per cent lower heat storage capacity, it is stated. This feature is of particular importance on intermittent furnaces that can be brought up to temperature in a much shorter time with less waste of heat each time the furnace cools, the manufacturers point out. Because the thermal conductivity of the new material is considerably less than half that of fire brick, radiation losses are also reduced, it is stated.

The material is particularly recommended by the makers for casting light-weight refractory shapes and for furnace doors and floors. It can be put in service after from 12 to 24 hours air-curing.

PATTERSON-BALLAGH CASING PROTECTORS

The original

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The genuine

•

Years-Tested

Made in our own plant devoted exclusively to their manufacture. These Casing Protectors are made of specially compounded rubber which we believe to be the highest tensile strength and the geatest wear-resisting rubber made in the U. S. These are the original Casing Protectors, developed by Patterson-Ballagh, of which hundreds of thousands have been sold in almost all rotary fields of the world. Under Patterson-Ballagh service there is available an ample stock of fresh Protectors in all active drilling fields. Free tool rental service is maintained at all points.

P-B Protectors are designed for operation on full hole tool joints as well as A.P.I. Special Protectors are made for special collars, drill pipe and subs. Protectors supplied for external up-set drill pipe and for flush joint drill pipe.

PATTERSON-BALLAGH CORPORATION

Plant and General Offices: 1900 East Sixty-Fifth St., Los Angeles, Calif., U.S.A.

Texas and Gulf Coast Distributors:
BETTIS SALES COMPANY
516 Merchants and Manufacturers Bldg.,
Houston, Texas

Oklahoma Office:
438 Northwest Twenty-sixth Street
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Fresh Stocks immediately available in

Casper, Wyoming	Lake Charles, Louisiana	Houston, Texas	Bakersfield, California
Oklahoma City	Houma, Louisiana	Odessa, Texas	Ventura, California
Ada, Oklahoma	Hobbs, New Mexico	Kettleman Hills, California	Los Angeles, California

Sold by all Supply Houses

75 Ampere Arc Welder

THE new 75 Ampere Hobart Arc Welder, illustrated herewith and recently announced by Hobart Brothers Company, Troy, Ohio, is said to be the result of two years' experimental and practical development.

The manufacturers point out that it embodies practically the same design and construction as their larger models—adhering to the same proven principles and including the same equipment.

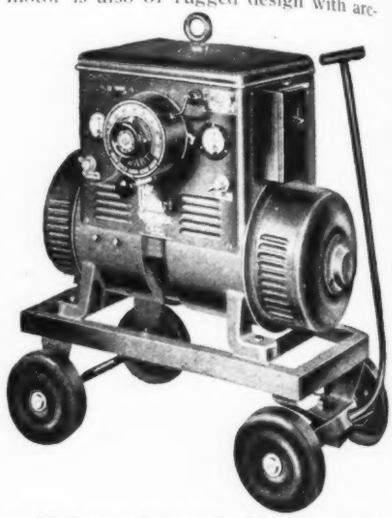
Rated at 75 amperes, 25 volts, being designed especially for light gauge welding, it has a welding range of 15 to 125 amperes in three steps and performs well on 24 gauge and heavier, using 1/16-in., 3/32-in. or 1/8-in. electrodes, either bare or coated. It is powered by a 3-hp. electric motor.

This model, which the manufacturers expect to find acceptance in plants working with light gauge metal, comes completely equipped with starting switch, polarity change switch, dual remote control, double-reading voltmeter, and double-reading ammeter.

It is provided with a convenient lifting eye on top and in the portable type (illustrated) is bolted to a sturdy, welded steel truck with four steel disc wheels and drawbar, making it easy to move about. It is easily demountable from the truck when desired, the reactance unit being enclosed in the attractive, pressed steel "Turret Top."

The volt-ampere curve of this machine approaches the vertical far more nearly than in connection with the larger machines, since it is especially intended for low current values, the makers state. The arc is extremely tenacious, even down to the very minimum current with which it is practical to weld.

The machine is of arc-welded steel construction throughout and there has been no skimping in all-important copper and electrical sheet, both the welding generator and the inbuilt exciter being of ample size and with ample brush capacity. The motor is also of rugged design with arc-



welded rotor bars and with stator ground concentric with bearings to insure a uniform air gap.

Motor, generator, and exciter, with special cooling fan, are carried on a single, heavy-duty, horizontal shaft with ball bearings mounted at the ends, as in the larger Hobart models. The long-life, economical speed of 1750 r.p.m. is also maintained in this smaller machine, it is stated.

Gas Burner for Oilfield Boilers

REFLECTING ease and simplicity of installation, as well as utilizing a new application of the radiant heat principle, the new N. G. E.-Nelson Series 1000 Gas Burner for oilfield boilers, is announced by Natural Gas Equipment, Inc., Petroleum Securities Bldg., Los Angeles, Calif.

The burner is said to represent a fundamentally superior, yet proven design, being a modification of the Venturi Tube, and operates upon the principle of entraining a major part of the air required for combustion by the pressure energy of the gas issuing from an orifice into the Venturi throat of the burner. This feature permits operation with less stack-draft, it is stated. By the use of a refractory bed supported by the burner, the gas is burned in a restricted and localized zone, so that a condition of incandescence is maintained. This method of heat application causes tremendous acceleration in the rate of combustion and produces a source of heat practically without flame and productive of exceptionally high efficiencies, the manufacturers say. Boilers heat up quickly when firing is started and cool off slowly when firing ceases.

Utilizing the principle of radiant heat to produce and maintain successfully high combustion efficiency, the new N. G. E.-Nelson Burner is said to incorporate every consideration for safety, capacity, boiler maintenance, economy of operation, and long life in service. The necessity of a firebrick combustion chamber is eliminated.

Circular will be sent upon request.

A pump that stays in the well for 7 years is plenty good for me!

Installed on March 18, 1928, the 2½" x 15' Removable Type FLUID PACKED Pump in Hathaway, Inc. Well A U No. 2 in Richfield District, California, has never been pulled up to the date this message is written—August 5, 1935.

Except for ordinary down time for repairs to surface equipment and rods, this pump has operated every day for almost 7 years and 5 months, at a depth of 2997 feet, and now is pumping 17 barrels of gross fluid each day.

Mr. Elwood Hathaway, pictured here, (one of three brothers who own several wells on this lease) jokingly says: "I thought when I bought a Fluid Packed Pump that it would STAY in the hole and pump oil."

See the Fluid Packed Pump Section in the 1935 Composite Catalog . . . or write our nearest office for complete information.

FLUID PACKED PUMP CO.

BOX 64 • LOS NIETOS, CALIFORNIA • U.S.A.

MID-CONTINENT AND TEXAS DISTRIBUTION

FLUID PACKED PUMP CO.—MID-CONTINENT

2 S. E. 29TH ST., OKLAHOMA CITY, OKLAHOMA

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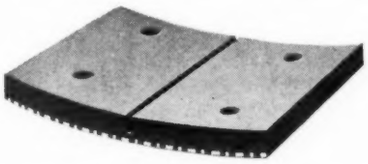
A MODERN PUMP FOR MODERN CONDITIONS

Protected by Patents No. 1545474, 1545475, 1549175, 1621046: others pending.

Grizzly Full-Moulded Brake Block

BRAKE lining for rotary drawworks has long been a source of trouble in oilwell drilling with rotary equipment. For years drilling crews have complained of smoke, odors, dust, etc., and engineers have spent much time in trying to remedy the condition.

This trouble is said to have been eliminated by a new type of lining—Grizzly Full-Moulded Brake Block, made by E. M. Smith Company, Los Angeles, California. This lining is made of more than 75 percent selected asbestos, impregnated with an efficient lubricant that lubricates and smooths the rims and insures a



highly polished surface, eliminating all possibility of scoring, the manufacturers state. No wire is embodied in the wearing surface. The blocks are full moulded under tons of hydraulic pressure to correct size and form to fit the rim perfectly.

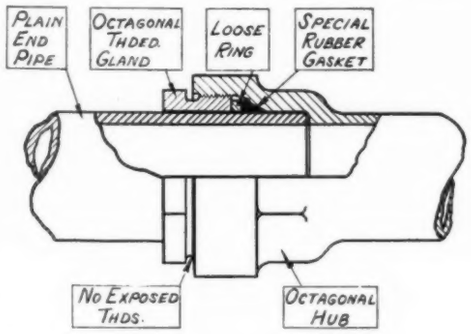
This dense material is practically heat, water, and oil proof, withstanding 2000 deg. fahr. of direct heat without heat-checking, it is said. The blocks retain their density and co-efficient of friction until completely worn out.

That Grizzly Brake Blocks will hold any load encountered in oilwell drilling is indicated by their service on some of the deepest wells in the world. They hold the load safely at any depth, feed smoother when drilling, eliminate scoring, and minimize wear and tear on other equipment by giving smooth stops at any line speed, the makers state.

Grizzly Full-Moulded Brake Blocks are manufactured by E. M. Smith Company, 600-650 South Clarence St., Los Angeles, California. They are distributed in the Mid-Continent by Continental Supply Company, and by T. T. Word Supply Company in all their stores.

"Hi-Test" Cast-Iron Pipe for Water and Gas Lines

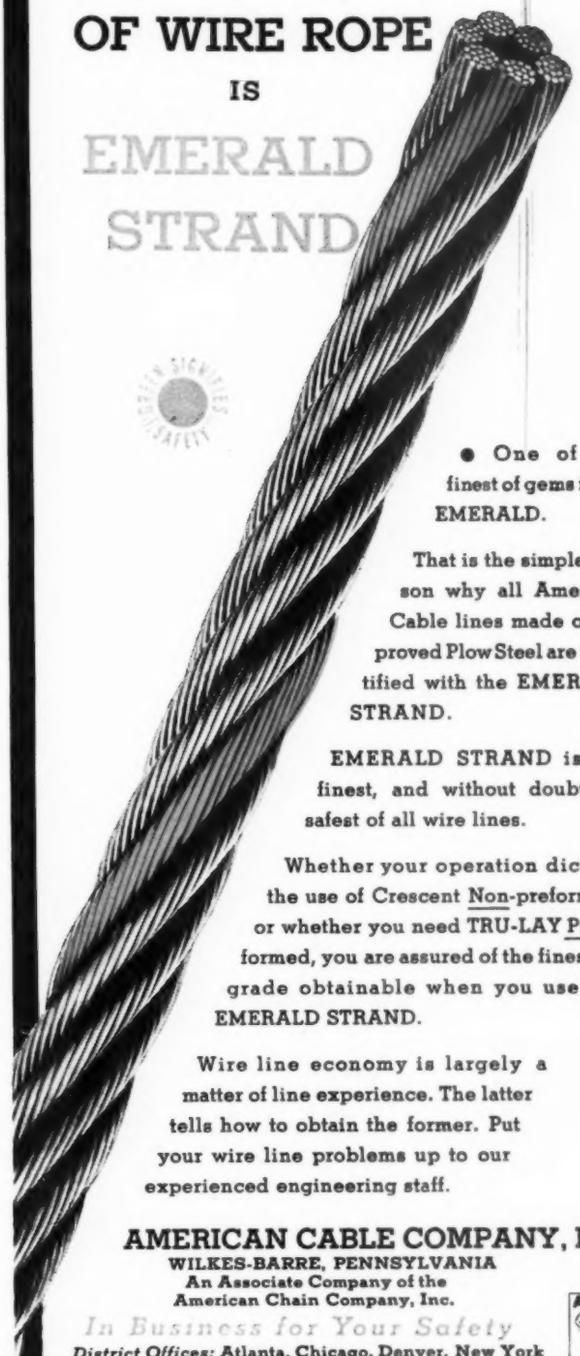
A NEW "Hi-Test" cast-iron pipe, developed for water and gas lines where service conditions are difficult, has recently been announced by the Walworth Company, 60 East 42nd Street, New York, N. Y. The new pipe is suitable for water working pressures of 175 lb. per sq. in. It is regularly furnished in sizes 1¼ in. to 6 in., inclusive, in 20-ft. lengths, with threaded joints for rapid assembly above ground, and can also be supplied in 5-, 10- and 15-ft. lengths. Expansion joints, easily made up with



open end wrenches after sections as long as 80 ft. to 100 ft. have been lowered into the trench, provide for axial and to some extent for lateral movement, and assure a bottle-tight joint under the service conditions for which the pipe has been designed, the manufacturers state.

Cast iron used in the "Hi-Test" pipe has an ultimate tensile strength of 35,000 lb. per sq. inch. Minimum bursting pressures for the threaded pipe range from 7000 lb. per sq. in. for the 1¼-in. diameter size to 1,500 lb. per sq. in. for the 6-in. size. If required, each length will be tested to a hydrostatic pressure of 500 lb. per sq. inch. Close tolerances, both as to weight and thickness variations, are a feature of the new line, it is stated. A bulletin giving complete specifications is available on request.

WHY THE FINEST (SAFEST) OF WIRE ROPE IS EMERALD STRAND



● One of the finest of gems is the EMERALD.

That is the simple reason why all American Cable lines made of Improved Plow Steel are identified with the EMERALD STRAND.

EMERALD STRAND is the finest, and without doubt the safest of all wire lines.

Whether your operation dictates the use of Crescent Non-preformed or whether you need TRU-LAY Preformed, you are assured of the finest grade obtainable when you use EMERALD STRAND.

Wire line economy is largely a matter of line experience. The latter tells how to obtain the former. Put your wire line problems up to our experienced engineering staff.

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An Associate Company of the American Chain Company, Inc.
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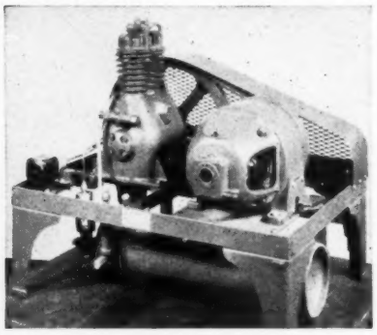
ACCO

AMERICAN CABLE
EMERALD STRAND
ROTARY LINES

Commercial Condensing Units

TO MEET the exacting needs of correct application, a new line of open-type commercial condensing units, available in three suction-pressure ranges, is announced by Westinghouse Electric and Manufacturing Company. The new units



are divided into low, standard and high suction-pressure classifications, as designated by the last letter in the model number, L-Low, S-Standard, and H-High.

The low suction-pressure range unit of the new Westinghouse compressor extends from 31 deg. fahr. below zero to five deg. fahr. above. The standard suction-pressure range is from 13.5 deg. fahr. below zero to 20 deg. fahr. above, while the high suction-pressure range is from 10.5 deg. to 40 degrees. This range of suction pressures may be had in all one hp. and one and one-half hp. models and standard and high suction ranges are obtainable in two hp. and three hp. models.

All air-cooled units are equipped with extra large shrouded condensers. This feature greatly improves the operation of the unit by directing the entire flow of air through the condenser and over the motor by an improved type of silent high-speed fan. With this directed air flow and a thermal overload starting switch with automatic reset furnished as standard equipment, the motor has dual protection against damage from overloading or uncontrollable power line disturbances.

Although the service valves are mounted on the side of the cylinder the suction and discharge valves are still contained in the head of the compressor, which is a feature Westinghouse has carried through its entire line of hermetically sealed and open-type condensing units.

In the design of this line, Westinghouse engineers have given particular attention to practical details; for example, the quantity of oil in the crank case of the compressor can be told by a glance at a sight oil level gauge that anyone can read.

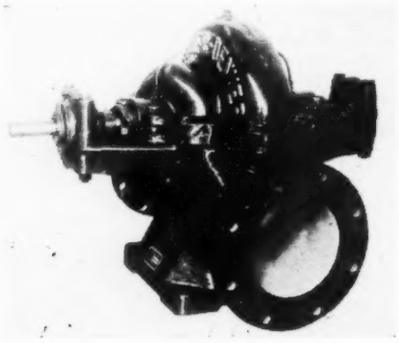
The capacities, speeds, and model numbers are:

Model	R.P.M.	Cooling Medium: Air, 90°F. Water, 75°F.	H.P.	CAPACITIES IN B.T.U.'s PER HOUR Refrigerant Temp. 40°F.	Refrigerant Temp. 20°F.	Refrigerant Temp. 5°F.	Refrigerant Temp.—10°F.
AFJ-100L	480	Air	1	.....	.....	5,300	3,390
AFJ-100S	410	Air	1	.....	6,600	4,580	3,000
AFJ-100H	320	Air	1	7,950	5,610	.....	.....
WFJ-100L	480	Water	1	.....	.....	5,925	3,980
WFJ-100S	410	Water	1	.....	7,350	5,030	3,240
WFJ-100H	350	Water	1	9,625	6,270	.....	.....
AFK-150L	410	Air	1½	.....	.....	8,000	5,505
AFK-150S	350	Air	1½	.....	9,250	6,915	5,080
AFK-150H	270	Air	1½	10,500	7,610	.....	.....
WFK-150L	480	Water	1½	.....	.....	10,350	7,065
WFK-150S	400	Water	1½	.....	12,100	8,455	5,560
WFK-150H	320	Water	1½	14,920	10,055	.....	.....
WFL-200S	350	Water	2	.....	16,600	11,418	7,300
WFL-200H	380	Water	2	20,550	13,500	.....	.....
WFM-300S	460	Water	3	.....	25,300	17,910	12,005
WFM-300H	400	Water	3	32,650	21,780	.....	.....

All units are charged with Freon (F-12) refrigerant.

Double Suction Centrifugal Pumps by Gardner-Denver

A NEW line of double-suction single-stage, split-case centrifugal pumps that, the makers state, combine a number of unusual features, has been announced by the Gardner-Denver Company, Quincy, Illinois.



This new line of pumps is adaptable to practically any class of service. They are designed for any type drive, including flat belt, V-belt, direct-connected, gas or Diesel engine, although the usual drive is connected directly to an electric motor.

All pumps in the D, E, F, and G series are identical in construction, the only difference being in dimensions. This series of pumps covers all heads up to approximately 300 ft., each type covering a certain percentage of head and thus enabling the buyer to select the exact type of pump for any head up to 300 feet.

Emphasizing the fact that these new double suction pumps are new in every respect, Gardner-Denver engineers point out a number of features of construction. Considerable attention has been given to making the pump easy to maintain, everything possible being done for the convenience of the operator. The shaft sleeve nut, for example, is placed outside the pump and next to the pumping housing, a convenience in tightening sleeves. This nut is also used as a jack to remove the ball bearing, no puller being required.

The bronze impellers are of the double suction enclosed type, hydraulically balanced. A large feather key firmly secures the impeller to the shaft. Double wearing ring construction is used, the impeller rings being made of bronze and securely held on the impeller with press and screw dowel pins. Casing rings are cast iron and are held in position by a tongue and groove fit, being shaped to continue the contour of the volute type suction passage.

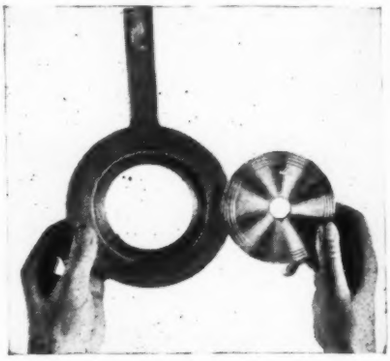
The casing itself is of cast iron. Gardner-Denver engineers state it produces the smoothest possible flow and gradual velocity changes. The casing is split on the horizontal centerline to permit access to the pump interior without disturbing the suction or discharge pipes.

The shaft is made of heat-treated high-carbon alloy steel accurately ground and polished. The shaft sleeves are cast bronze, machined to a very smooth surface. These shaft sleeves are firmly held to the shaft by an extension of the impeller key and also by the nut outside the packing box, this nut also being used to adjust the impeller centrally in the casing.

Stuffing boxes are extra deep, glands are split and held in place by swing bolts and brass clips to facilitate removal, while bearings are of the heavy-duty ball type, designed for heavy thrust and radial load. Bearings are enclosed in splash-proof and dust-proof housings. All pumps are accurately tested in a modern, up-to-date laboratory at the Gardner-Denver plant.

Orifice Plates Can Be Salvaged

BY means of a simple machine operation, thousands of dollars worth of discarded orifice plates can be salvaged,



The new Daniel insert or wafer plate of stainless steel.

thus saving oil and gas companies this loss, according to Paul P. Daniel, president, Daniel Orifice Fitting Company, Los Angeles.

"When the conventional type of orifice plate of ¼-in. thickness has been rebored to the point where the ratio of the orifice is too large to meet the accepted limits that would permit practicable use," says Mr. Daniel, "the plate is usually junked or discarded as useless. By a simple machine operation, we are converting these hitherto useless plates into holders that can be used again and again with the simple, inexpensive Daniel stainless steel inserts or wafer plates."

Complete information regarding this new process can be obtained from the Daniel Orifice Fitting Company, 2719 Elm Street, Los Angeles, or their agents, the Paramount Manufacturing Company, Los Angeles and San Francisco; the M. N. Dannenbaum Company, Houston, Texas, and G. W. Daniel, Tulsa, Oklahoma.

YOU CAN *Change* THE *Cutters* QUICKLY AND EASILY ON THE *Derrick Floor*

THE ease with which the cutters are changed makes the Globe Roller Bearing Rock Core Bit first choice with field men.

Its fast cutting action and a high recovery of complete cores from the hardest formations, as well as from formations consisting of alternating hard and soft strata, win the approval of field men, geologists and engineers.

FOR HARD FORMATION

The double core catcher consists of a slip-type catcher which is capable of pulling the hardest cores, and . . .

FOR ALTERNATING HARD AND SOFT FORMATION

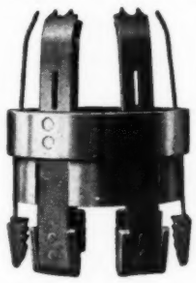
the dog-type catcher (or mousetrap) secures an effective grip on cores from any formation, and is necessary for holding broken or soft cores.

ALL YOU NEED IS A WRENCH, A HAMMER, AND A COLD CHISEL!

Type KR

GLOBE ROLLER BEARING ROCK CORE BIT

Soft or broken cores are successfully recovered with the dog-type catcher.



The slips take a positive grip for pulling the hardest cores.

Easily adapted to run on the new

GLOBE TYPE K EQUIPMENT
and on the famous

GLOBE-SMITH TYPES A, B & C CORING EQUIPMENT

See pages 391 and 392 in your 1935 Composite Catalog for details, or write us giving information as to the type and size of equipment you desire to run.

Note the strong, simple design and the floating inner barrel.

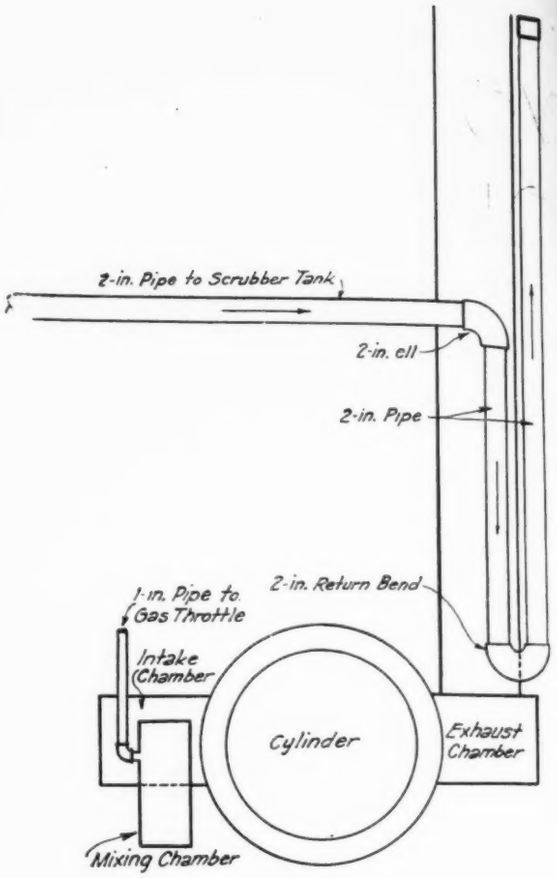
DRILLING, REAMING AND CORING EQUIPMENT

Look for this Trade Mark in the Composite Catalog

GLOBE OIL TOOLS

GLOBE OIL TOOLS COMPANY
(Los Angeles County)
Los Nietos, California, U.S.A.

Sketch showing details of the vaporizing coil as it comes from scrubber tank.



A Vaporizer for Wet Fuel Gas

By S. B. CRISSEY

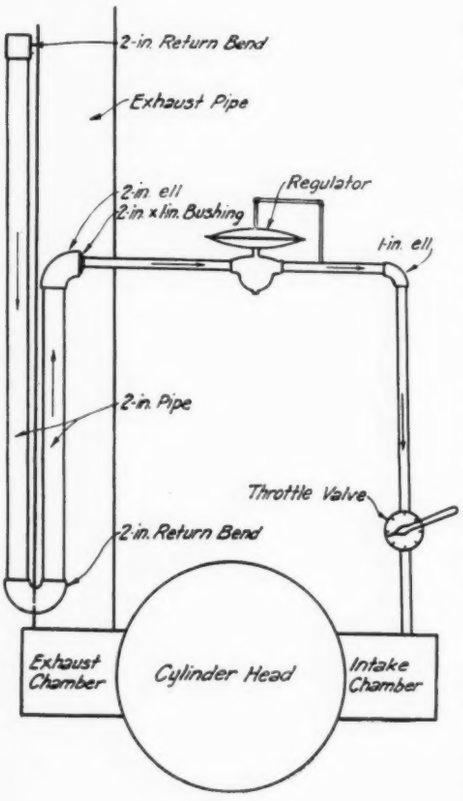
CASINGHEAD GAS, rich in gasoline content, causes many troubles and much expense when used as fuel in low-compression engines. The wet gas, laden with particles of gasoline, expands when drawn into the hot cylinder, causing the engine to knock and blow by the rings. The knocking and hammering causes leaking gaskets and sometimes broken cylinder heads while the heated charge, blowing past the rings, causes scored pistons and cylinder walls and lost lubrication.

Faced with the necessity of having to use such gas for fuel, several methods were tried before a successful way of eliminating these troubles was found.

Vacuum pumps were used on the leases, the gas being discharged from the pumps into the fuel lines. As one pump pulled the vacuum from several leases, it was necessary to carry a pressure of five lb. on the fuel lines to insure a return of gas to the engines. This pressure caused the gas to condense in the lines and the gasoline was carried into the engines with the above-mentioned results.

Drips made of 6-in. pipe were laid in the fuel line to catch this gasoline and a 16-in. by 6-ft. scrubber tank was set at the power. The engine still knocked, however; gaskets blew out and, worst of all, so much of the gas was being drawn from the drips in the form of gasoline that it was causing a shortage of fuel for the engines.

A vaporizing coil (see accompanying sketches) was then made and resulted in a very smooth-running engine and a plentiful supply of gas. The outlet line from the scrubber tank was brought through the wall of the power a few inches below the eaves, and carried overhead to the exhaust pipe of the engine. This 2-in. pipe was cut off flush with the exhaust pipe and threaded for a 2-in. ell looking down. A piece of 2-in. pipe was then cut and threaded on both ends so that when screwed into the ell and placed against and parallel to the exhaust, the end came six in. above the exhaust chamber. A 2-in. return bend was placed on this pipe at the lower end just above the exhaust chamber and a 2-in. pipe, which extended up the exhaust to within six in. of the roof of the power, was screwed in the bend. Another return bend was placed on this pipe and a second pipe the same length as the last screwed into this, running back down the side of the exhaust pipe. Another return bend screwed on this pipe with a 2-in. pipe the same length as the first, screwed on the return bend. This made a coil that ran up and down and around the exhaust pipe, a total distance of 32 ft., and through which the gas had to pass to reach the engine.



A 2-in. ell with a 1-in. bushing was screwed on the last riser of the coil and a 1-in. riser with ell on top was screwed on the throttle valve. The regulator was then flanged up above the engine between the 1-in. ell and the 2-in. ell with the bushing. A clamp was made from ⅛-in. by 2-in. strap iron and the coils were drawn tight against the exhaust pipe.

The heat from the exhaust pipe warmed the gas as it passed through the coils, vaporizing the tiny particles of gasoline and expanding them into gas. As the gas had only seven ft. to travel through 1-in. pipe before reaching the engine it did not have time to cool and condense. It is important that the regulator be placed between the throttle and coil to keep the expansion of gas in the coil from putting a pressure on the engine.

The gasoline drips were then removed from the line, allowing all the gasoline that formed to be drawn into the hot coils and vaporized into a dry gas. This resulted in a surplus of gas where before there had been a shortage.

Details of the vaporizing coil between the exhaust and the intake chamber. Note that the regulator is placed between the coil and the throttle valve.

How safe—how practical—how completely dependable the BAKER ROTARY WALL SCRAPER is, you would take advantage of the exclusive profit making work it will perform

It scrapes rotary mud from the face of the oil sand, and enlarges the area to secure maximum production.

It enlarges the diameter for setting larger sizes of casing or liners, and eliminates possibility of "tight" holes.

It scrapes a wide, flat shoulder as the first step in bringing a crooked hole back to vertical.

AND blades always open by pump pressure at exactly the desired point, and they always close when coming out of the hole.

You can cut to any specified 1/4" diameter up to the capacity of the tool in use. For example, a No. 6 Baker Wall Scraper runs in through 9 5/8" casing and reams any desired diameter from 9 1/4" to 19".

So, we repeat, if you really knew how the Baker Wall Scraper can make your operations both safer and more profitable, you would no doubt be using one today.

Why not write for additional information, or . . .

look for **BAKER** *in*

It enlarges the bottom 20 to 40 feet of hole to insure complete distribution and a better bond of cement around the shoe.

It reams out old cement and makes it possible to secure bottom water shut-off when re-cementing.

BAKER OIL TOOLS, INC.

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COALINGA • TAFT • HOUSTON • OKLAHOMA CITY • TULSA • NEW YORK

Engineering Fundamentals Department

- A Study Course for Field and Plant Men
- A Review for Experienced Engineers

W. L. NELSON
K. C. SCLATER
Editors

Elements of Applied Petroleum Production

By K. C. SCLATER

Article 23

CLEANING-OUT AND REPAIRING WELLS (Continued)

CLEANING-OUT WITH COMPRESSED AIR

SMALL oil wells are also cleaned out with compressed air. This process of cleaning-out was successfully applied to wells in the Marietta, Ohio, district about 15 years ago. It was in this district that compressed air was first used for repressuring. The use of compressed air for repressuring led to its use also for cleaning-out wells.

A few years after its successful application in Ohio, the compressed air process was used for cleaning-out in the Mid-Continent fields. It was first tried out with very successful results in the Lenapah pool, Oklahoma, in 1924. Wells 900-1000 ft. deep and with 40 ft. of sand and cavings in bottom were cleaned out in three or four days.[90] The process was also adopted for use in other fields of the Mid-Continent with good results.

The process "consists of lowering the tubing into the well, with a shoe or nipple of heavy pipe substituted for the perforated anchor on the bottom. Into the tubing, compressed air is introduced through a rotary swivel hose at the top, or by means of swing connections. The tubing is lowered to the top of the cave to be cleaned out, several barrels of water are put into the hole, and the compressed air is turned on. This blows out the material between the casing and the tubing, the tubing being lowered as the material is removed.

"By this means, the shale cavings, loose sand, rocks, paraffin and other substance can be blown out in a surprisingly short time, and more completely than is possible by drilling tools and sand pumps. Any rocks large enough to pass out of the hole will be ejected and larger rocks can usually be crushed by means of the heavy nipple or shoe, on the bottom of the tubing, which can be raised and lowered by a winch. For the shallowest wells, 100-lb. pressure can be used, though not with entire satisfaction. For deeper wells, greater pressure and volume are needed, though not in direct proportion to the depth. Wells as deep as 2800 ft. were cleaned out in Wyoming by high-pressure air."[90]

High-speed, two-stage, portable compressor units with an accumulator tank and capable of pumping the tank up to 500-lb. pressure delivered the required volume of air continuously. This outfit was mounted on steel I-beams, which formed the frame of a trailer. The tractor was equipped with a winch so that only a pulling mast was necessary to complete the outfit for cleaning-out operations. This outfit was designed for wells 600-700 ft. deep.

"In operation, the train is run up to the well, a pulling mast is set up over the well, and the rods and tubing are pulled by means of the winch on the tractor, or other pulling devices. The shoe or heavy nipple is then substituted for the perforated joint of tubing, and the string is run in again with the working barrel.

"The rotary swivel and hose, which connects it to the air tank at the port in the top, is attached to the top of the string of tubing. The compressor is then run until the tank is charged to 400-lb. or 500-lb. pressure. This charge is then let into the tubing, which is lowered as the well is cleaned out, until the pressure drops to 150 or 200 lb., when it is too low to be effective.

The tank is then again charged, which takes from 25 to 35 minutes, and the operation repeated until the well is cleaned to the bottom; the well can then be thoroughly washed out. The pressure is then introduced into the casing, which forces all the remaining floating sand and fluid out through the tubing. This operation leaves the well in a thoroughly clean condition, after which the rods with working parts of the pump are run in and again put to pumping. The tubing shoe is left in the hole so that the next time the wells are cleaned out, it will only be necessary to pull the rods and working parts."[90]

In one district in Oklahoma, one company reports that 20 wells were cleaned with compressed air at an average cost of $237.50 per well. It was also reported that "the average time required to clean these wells was three days, including pulling and putting the wells back to pumping, and the production was increased an average of 1¼ bbl. per well per day, on wells that had produced ¼ bbl. per day. The average time for cleaning with cable-tool machines, in this district, was 51 days per well, based on the last five wells cleaned out by this company, and the average cost approximately $1000. The cable-tool cleaning out did not noticeably increase production.

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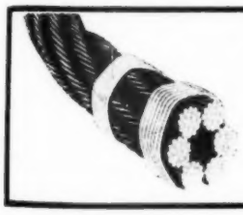

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"The average cost ($237.50) of cleaning the wells with compressed air includes fuel, labor, and material, depreciation, and royalty."[90]

Difficult conditions in the well are sometimes found that may necessitate modifying the process. For example, "The pay sand in some fields is in the bottom and it is necessary to keep the wells pumping at the lowest possible point, as the wells only contain seven or eight ft. of fluid. By the reversing method, that is putting the pressure in the casing and flowing up the tubing the remaining fluid, which consists of floating sand, shale, and oil, it is possible to remove all debris in the well and pump it on bottom. But where the sand is very open, as at Burkburnett, pressure cannot be held so this method can be applied; in such conditions the special tool is used. During the first eight hours of cleaning with the special tool, about 15 bbl. of pure sand was removed; 23 hours were required to clean out the well after the special tool was used."[90]

It should be noted that the facts and figures here quoted on cleaning out wells with compressed air are from the experience of only one company.

CLEANING-OUT WITH NATURAL GAS

Instead of compressed air, natural high-pressure gas is also used for cleaning out wells. The use of gas is often more convenient than compressed air. Its availability in the field obviates the cost of compression that is usually incurred in compressing air.

Deep wells cannot always be cleaned out by ordinary methods and the use of natural high-pressure gas is resorted to. If rotary methods are used on a deep well that has a low bottom-hole pressure there is danger of damage to the producing sand from the pressure exerted against it by the fluid column.

Where there are large cavities in a well the use of cable tool equipment for cleaning out may not be desirable.

High-pressure gas for cleaning out is used in the same manner as compressed air. This method has been used in the Oklahoma City field and "consists essentially of circulating high-pressure gas down through and up around the well tubing. The return flow of the gas, together with the fluid that the well makes, is used to flow out the unconsolidated cavings. Cavings are rapidly flowed from the well, and the danger of losing tools in the cavities is minimized. The entire clean-out operation is carried out without exerting a pressure against the face of the sand in excess of formation pressure, and with the well producing into the separator at its maximum capacity."[91] It is to be noted that wells can produce into the separator at their maximum capacity while being cleaned out by this method, because no pressure is exerted at the face of the producing sand.

"The equipment required for the successful operation of the process consists essentially of a string of tubing containing two check valves (one at the top and one at the bottom), a high-pressure hose connecting the tubing swivel and the gas supply, and suitable control equipment that permits free movement of the tubing while the well is flowing. In addition to the customary well-pulling equipment for raising and lowering the tubing, there are provided a weight indicator, and a pressure gauge, or preferably an orifice meter, on the input gas line. A portable hoist or tractor is used for power.

"Tubing of 2-in. or 2½-in. dia. is used in the Oklahoma City work, and after cleaning-out is completed, the string of tubing is usually left in for flowing the wells by gas-lift. From 150 to 200 ft. of inserted tubing or internal upset flush-joint drill pipe is used on the bottom to eliminate any possibility of collars sticking the pipe in the open hole. The bottom check valve, which is built inside the tubing shoe, prevents heaving sand from plugging the tubing in the event gas circulation is accidentally interrupted; it also prevents the well from flowing through the tubing while the pipe is being pulled. The second check valve, placed near the top of the string, permits adding additional joints without releasing the pressure already in the tubing. The tubing shoe, or bit, usually has a restricted outlet, this restriction acting both to limit the rate of discharge of high-pressure gas out of the tubing while a new joint is being swung up and to make the action of the orifice meter more sensitive."[91]

QUESTIONS

1. Describe briefly the process of cleaning-out shallow wells with compressed air.
2. What pressures are used in cleaning-out with compressed air?
3. What is the reversing method of cleaning-out with compressed air, and under what conditions is it used?
4. Under what conditions is it advantageous to clean-out deep wells with high-pressure natural gas?

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[90]"Cleaning Oil Wells by Compressed Air," by A. A. Beard and R. A. Bonnell—*A.I.M.E. Petroleum Development and Technology*, 1925.

[91]"Cleaning-Out Oklahoma City Wells With Gas," by J. S. Ross—*The Petroleum Engineer*, September, 1934.

Special Trains to Carry Oil Men to Institute's Annual Meeting

Preparations for the sixteenth annual meeting of the American Petroleum Institute at Los Angeles, California, include plans not only for special trains, but also for an "Oil Men's Caravan." The "Caravan," arrangements for which are being made by R. A. "Dick" Wotowitch, of the Warner-Quinlan Company, 2 Park Avenue, New York, will permit oil men attending the meeting to make the trip without thought for details once they go aboard a chartered train. Meals, berths, schedules, changes, automobile and bus hire, tips, and other miscellaneous items will be taken care of by the "Caravan" managers and without further thought on the part of the "Caravaneers." Reservations will be available to oil men at New York and to those leaving from cities en route, but the managers will permit use of the train to none except active oil men.

Reservations already have been made by delegations from New York, Pennsylvania, Ohio, Washington, D. C., and Illinois. The "Caravan" will follow the routes of the Pennsylvania, Missouri Pacific, Denver and Rio Grande Western, and Union Pacific lines.

The New York Central and Santa Fe railroads have announced plans for operating the "American Petroleum Institute Special" as a de luxe train for members and their families attending the annual meeting. Modern air-conditioned Pullman equipment will be provided, with club, observation, lounge, dining, compartment, drawing-room and open section sleeping cars. Valet, maid, and barber shop service, as well as daily market reports and news bulletins, will be available. Opportunity will be had for sightseeing or stopovers on the return trip, and different routes may be followed.

The special leaves New York on the Central lines at 4:15 p. m., Thursday, November 7, leaves Albany at 7:10 p. m., and Buffalo at 1:02 a. m., Friday. The special leaves Chicago on the Santa Fe lines at 12:30 p. m., Friday, leaves Albuquerque, N. M., at 7:05 p. m., Saturday, November 9, and arrives at Los Angeles at 4:00 p. m., Sunday, November 10.

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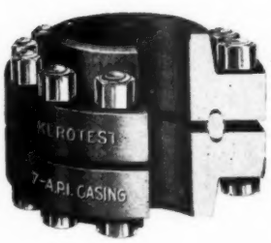

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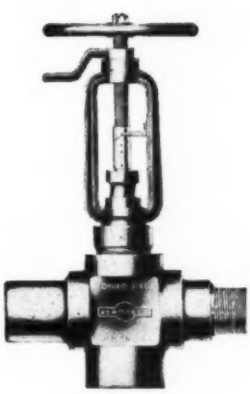

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Elements of Applied Petroleum Refining

By W. L. NELSON
Consultant*

Article XXIII

FRACTIONATION

THE subject of petroleum fractionation is seldom discussed or explained in a satisfactory manner because the behavior of complex mixtures is not entirely understood. For this reason the subject of fractionation is usually discussed from the standpoint of two-component systems, or for mixtures containing only two liquids. The mechanism of fractionation is complete and satisfactory when applied to two-component systems but it is hopelessly involved for practical work involving complex mixtures. The theory of two-component systems will not be completely discussed in these articles but those who wish to obtain a comprehensive background for the study of fractionation may refer to other references.[1,2]

Fractionation may be defined as any operation by which a liquid mixture is separated into pure liquids, or into products whose boiling-range is narrower than the boiling-range of the original material. However, the term is often used in a more restricted manner, and there are several other terms that are really special phases of fractionation. *Distillation* is usually referred to as a complete operation that may involve heating, vaporizing, fractionating, condensating, and cooling. *Dephlegmation* is a type of fractionation in which a vapor mixture is progressively cooled so that successively lower- and lower-boiling condensates can be collected as separate fractions. The method is seldom used at present because of the relatively poor separation that is obtained. In a more restricted usage, *fractionation* is defined as a counter-current operation in which a rising mixture of vapor is repeatedly contacted with a descending flow of liquid. The definition is not complete unless it is explained that the vapor is partially condensed by the liquid and that in so doing, the liquid is partially vaporized and thus produces a purer vapor during each contacting operation.

The equipment used in conducting fractionation is referred to as towers, one common form of which is the bubble-tower. An idea of the mechanical design of such a tower may be gained from Fig. 9, Article III of this series, January, 1934. Many different plate arrangements and types of caps are used, but the principles of fractionation are the same in all types of towers. If the feed is introduced at the center of the tower, the plates above the feed are called *rectifying* plates, and the plates below the feed are called *exhausting* plates. However, the plates below the feed plate cannot properly be called exhausting plates unless heat (or hot vapor) is supplied at the base of the tower and in most petroleum towers no heat is supplied at the base of the tower. Occasionally reboilers, by which the liquid in the bottom of the tower is heated in a part of the pipestill and then returned to the base of the tower, are used. In the common arrangement no heat is supplied but steam is admitted below the bottom plate and this steam strips or removes the low-boiling material from the bottoms product as it flows down the tower. This operation is referred to as *stripping*.

*Professor of Petroleum Refining, University of Tulsa.

MECHANISM OF FRACTIONATION

The purification of a liquid mixture by fractionation is based on the equilibrium relationships that were discussed in Article XXI, July, 1935. Fig. 43 given in the same article, will serve as an example of equilibrium relations. Referring to Fig. 43, a mixture containing 50 percent of butane will generate a small amount of vapor that contains 73 percent of butane if it is heated to 177 deg. fahrenheit. The vapor can be condensed and the operation repeated by heating the condensate to 160 deg. fahr., thus generating a small amount of vapor having a composition of 89.5 percent butane. This operation may be repeated as many times as desired until nearly pure butane is produced. A series of such operations is shown in Table 34.

TABLE 34
Theoretical Fractionation

	Composition (Percent Butane) Liquid	Vapor	Temp. in Still
First Still — Feed	50	73	176
Second Still — 1st Condensate	73	89.5	160
Third Still — 2nd Condensate	89.5	96	151
Fourth Still — 3rd Condensate	96	98.5	147.5
Fifth Still — 4th Condensate	98.5	99.5	146

The operations shown in Table 34 could be conducted in equipment as shown in Fig. 47. However, the rapid rate of purification indicated in Table 34 and Fig. 47 cannot be practiced commercially because only a very small amount

The above illustration shows an O.C.S. Duck, 20 H.P., double reduction pumping unit, pumping a 3,500-foot well in Oklahoma

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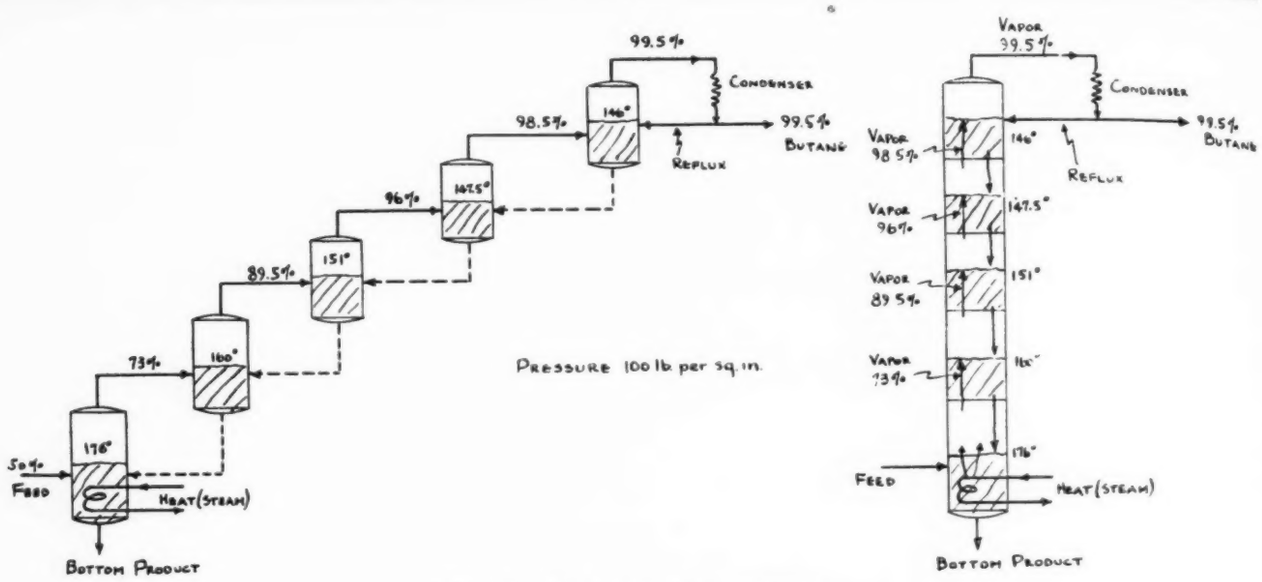

Fig. 47. Mechanism of Fractionation

of 99.5 percent butane could be produced. In practice several plates or stills are required to accomplish the purification that is shown for each plate in Fig. 47.

Note particularly that heat must be applied at the base of the tower to generate the vapors that ascend from plate to plate. The heat may be applied by direct firing of a shell-still, or steam coils may be used. Note also that reflux or some means of cooling must be used at the top of the tower. If no cooling were accomplished at the top, the vapors would ascend the tower and pass from the top plate without even being condensed. The reflux heat (or cooling) may be removed by the use of a cooling coil in the top of the tower or more commonly by putting some of the pure product, which has been cooled, into the top of the tower. The cool reflux (or top product) is heated and vaporized in the top of the tower and it all returns as a vapor to the product storage tank. More detailed information concerning the removal of reflux heat is presented elsewhere.[3]

HEAT BALANCES

When dealing with two-component systems it is possible to compute[1,2] the number of plates required and the amount of reflux, to produce a particular product, but when designing towers for complex mixtures, it is necessary to select the number of plates between products by a consideration of existing plants. One of the main reasons for our inability to compute the number of plates that are required, is the fact that several products are usually separated in one tower (multiple draw-off tower) whereas in a two-component system only a top product and a bottom product are produced. Likewise, the reflux that is required for a multiple-draw petroleum tower must be determined by means of a heat balance because the relation between the reflux and the number of plates cannot be computed.

The approximate number of plates that should be used may be estimated from Table 35. The quantities of plates given in the table are for a spacing between plates of about 22 in. unless otherwise indicated.

TABLE 35

Operation	Materials	Number of Plates between products
	Distillation at Atmospheric Pressure	
Topping	Gasoline and Kerosene	5–6
	Kerosene and Gas Oil	4–5
	Gasoline Oil and Wax Distillate	3–5
All operations	Stripping plates	3–5
Pressure Dist. Rerun	Cracked Gasoline and Feedplate	8–10
Pressed Dist. Rerun	Gas Oil and Neutral	4–5
Solution Rerun	Naphtha and Gas Oil	4–5
	Gas Oil and Neutral	5–6
Lubricating Stocks	Wax Dist. and Distilled Cyl. Stock	7–10
	Vacuum Distillation	
Lubricating Oils	Gas Oil and Wax Dist	2–3*
	Wax Dist. and Distilled Cyl. Stock	3–4*

*At a plate spacing of 30 in.

In determining the amount of reflux that should be pumped into the top of the column, a heat balance must be computed. The feed stock comes into the tower at an elevated temperature and inasmuch as the separated products are withdrawn at lower temperatures, heat must be removed. A heat balance consists simply of a computation of the amount of heat that must be removed. In other words, each product must be cooled from the feedplate temperature to the temperature at which it is withdrawn, and if it is withdrawn as a liquid, the heat required to condense the product must also be computed. Enough reflux or cooling agent is used to remove the above amount of heat.[3] The computation can be most easily explained by means of an example and hence the operation indicated in Fig. 17, Article VI, April, 1934, will be studied in Example 35.

EXAMPLE 35. *Heat Balance of a Pressure Distillate Rerun Unit.* (Fig. 17.)

The amount of reflux required for the tower shown in Fig. 17 will be computed when 1000 bbl. per day of material is being processed. The temperatures in the tower are usually estimated by considering other plants of the type being studied but they can be computed.[4]

In this example the following tower temperatures will be used:

Top Temperature - - - - 210 deg. fahr.
Vaporizer or Feedplate - - 260 deg. fahr.
Bottom Temperature - - - 240 deg. fahr.
Steam Temperature - - - 300 deg. fahr.
Reflux Temperature - - - 100 deg. fahr.

The quantities and physical properties are as follows:

Material	Percent	B.P.D.	Gal. per hr.	A.P.I.	Lb. per gal.	Lb. per hr.	Latent Heat at tower temp.
Cracked Gasoline	85	850	1490	57	6.25	9320	122
P. Dist. Bottoms -	15	150	260	32	7.21	1880	.....
Treated P. Dist. -	100	1000	1750	52.7	6.4	11200	.....

The process steam amounts to about 3000 lb. per hour.

Heat removed in cooling:

Gasoline $9320(260-210)0.46^{*} = 214{,}000$ B.t.u.per hr.
Bottom $1880(260-240)0.55 = 20{,}700$
Steam $3000(300-210)0.5 = 135{,}000$

*Sp. Ht. of Vapor.

Heat to condense gasoline:

$9320 \times 122 = 1{,}140{,}000$
Reflux Heat $= 1{,}509{,}700$ B.t.u. per hour.

This amount of heat (reflux heat) must be removed from the tower by means of liquid reflux, which enters the tower at 100 deg. fahrenheit. The reflux is heated to 210 deg. fahr. and vaporized in the top of the tower.

Let $x =$ lb. of reflux per hr.

$$x(210-100)0.54 + 122x = 1{,}509{,}700$$

$$x = \frac{1{,}509{,}700}{(210-100).54 + 122} = 8300 \text{ lb.}$$

or $\frac{8300}{6.25} = 1330$ gal. per hr.

DIAMETER OF TOWER

The diameter of the tower is based on the vapor velocity that can be permitted inside the tower and particularly the velocity at the top of the tower. Too high a velocity will cause the liquid in the tower to be carried from plate to plate and spoil the separation that is obtained and even cause it to entrain from the top of the tower into the storage tank. However, the allowable velocity is not a simple function. It depends on the pressure in the tower, the density or weight of the vapor and liquid, the spacing between the plates, the amount of reflux flowing down the tower, structural details of caps and plate, and the physical properties, particularly the surface tension, of the liquid. For this reason it is impossible to give definite values of the allowable velocity. Nevertheless, the approximate linear velocities given in Table 36 will be useful for estimating purposes.

TABLE 36
Approximate Allowable Tower Velocities

Operation	Pressure lb. per sq. in. Abs. or mm.	Plate Spacing, inches	Tower Velocity ft. per sec.
Topping	27	22	2-2.5
Cracking	40	22	1.2-1.7
Other Atmospheric Distillations	20-25	22	2-3*
Vacuum	30 mm.	30	9-12
	90 mm.	24	5-8
Stabilizer	160	18	1.7-2.2
Nat. Gaso. Absorber	50	14	.8-1.2

*High values if much steam is used.

The best method of determining the allowable velocity will not be discussed herein because it is too complicated, but those who are interested may refer to the method proposed by Brown.[5]

In using the tower velocity, the space occupied by the plates, caps, etc., is not considered. The vapor that passes through the top of the tower consists of the overhead product and the vapor that arises from the plate below the top plate to heat the reflux.

EXAMPLE 36. *Diameter of Fractionating Tower.*

The diameter of the tower studied in Example 35 will be computed. The molecular weight of the gasoline is about 120.

The vapor that arrives at the top of the tower consists of steam, the overhead product or gasoline, and the reflux vapor that arrives at the top plate to heat and vaporize the liquid reflux that is pumped into the top of the tower.

Reflux vapor: $\frac{1{,}509{,}700}{122} = 12{,}350$

Mols of vapor:

Reflux vapor, $\frac{12{,}350}{120} = 103$

Gasoline vapor, $\frac{9{,}320}{120} = 77.6$

Steam, $\frac{3000}{18} = 166.7$

Total mols of vapor, 347.3.

The pressure at the top of the tower will be about 20 lb. per sq. in. absolute.

Volume of vapor $= 347.3 \times 359 \times \frac{(210-460)}{492} \times \frac{14.7}{20} \times \frac{1}{3600} = 34.6$ cu. ft. per sec.

At an allowable velocity of 2.75 ft. per sec.:

Cross sectional area $= \frac{34.6}{2.75} = 12.6$ sq. ft.

$\left(\frac{\text{Dia.}}{2}\right)^2 3.14 = \text{Area.}$

Diameter $= \sqrt{\frac{12.6}{.785}} = 4$ ft.

QUESTIONS

1. What is meant by the term "distillation"?
2. Why is reflux necessary in any tower system?
3. What is the most common spacing used between plates?
4. What range of velocity is used in atmospheric fractionating towers?
5. List several of the factors that govern the allowable tower velocity.

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Note particularly the references 1 to 5, given here.

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Elements of Applied Petroleum Pipe Line Transportation

By C. E. MAIN, Sr.
Engineer, Sinclair-Prairie Pipe Line Co.

Article 14

FLOW OF LIQUIDS IN PIPE LINES (Part III)

FOR a number of years the writer has used for turbulent flow computations the four values:

$$b = 0.018168$$
$$x = 1.25$$
$$n = 1.75$$
$$w = 0.25$$
$$\frac{2n + x}{n} = 2.714$$

which will be found to give surprisingly close results in pipes that are known to be clean and free from paraffin and B.S.

Relation of Chezy ($f\mu$) and the argument B/DKN.

The equation of a straight line on the graph, Fig. 1 (see pp. 82-83, August issue) may be taken as:

$$f\mu = \frac{4196.56^{2-n} b}{\left(\frac{B}{DKN}\right)^{2-n}} \quad \ldots\ldots\ldots \quad (11)$$

Log 4196.56 = 3.6228936.

in which:

b = coefficient of roughness in the Hagen formula.
$f\mu$ = Chezy friction factor, including the viscosity effect.
K = kinematic viscosity in poises.
N = number of parallel lines of a given diameter.
B = discharge in bbl. of 42 gal. per hour.

By transposition of Equation (11) we obtain the equation for the value of the Hagen coefficient of roughness b:

$$b = \frac{f\mu \left(\frac{B}{DKN}\right)^{2-n}}{4196.56^{2-n}} \quad \ldots\ldots\ldots \quad (12)$$

and by transposition of Equation (5) we find:

$$b = \frac{2gb\, D^{2n+x} N^n}{AMB^n k^w} \quad \ldots\ldots\ldots \quad (13)$$

then

$$\frac{f\mu \left(\frac{B}{DKN}\right)^{2-n}}{4196.56^{2-n}} = \frac{2gbD^{2n+x} N^n}{AMB^n k^w}$$

and if we combine these two equations, we find that the exponent of N is 2.

In the above demonstration it is clearly shown that the N computed by Equation (10), to use in the Hagen formula is the same N to use in the Chezy formula, when taken as the equivalent number of lines of a chosen diameter in one section of the station district; however, in computing the equivalent length of a section of pipes for a single line, Equation (8) must be rewritten for use in the Chezy formula as:

$$M_1 = \frac{M}{N^2} \quad \ldots\ldots\ldots \quad (14)$$

as will be demonstrated by combining Equations (12) and (13) and solving for the friction head h:

$$h = \frac{5180.725\ f\mu\, M\, B^2}{2g\ D^5\ N^2} \quad \ldots\ldots\ldots \quad (15)$$

$$5180.725 = \left(\frac{A \times 100^{2-n}}{4196.56^{2-n}}\right)$$

and Log 5180.725 = 3.7143905.

which is the Chezy formula, the same as would be obtained by substituting in Equation (2).

The substitutions in Equation (2) result in

$$5180.725 = 5280 \times 12 \left(\frac{42 \times 231 \times 4 \times 12^2}{60 \times 60 \times 1728\pi}\right)^2$$

Selection of the size of pipe for equating each of the various diameters of the parallel lines, in each of the sections of a station district, when the Chezy formula, Equation (15), is used, should be examined mathematically due to the difference in the value of the argument B/DKN and also in the friction factor ($f\mu$) for 8-in. and for 12-in. pipe.

The line selected on the graph, Fig. 1 (see pp. 82-83 August issue), has a slope of $0.25 = w$, from which we compute the values of the other exponents, $x = 1.25$ and $n = 1.75$.

Using these exponents in Equation (10), with $D_1 = 7.981$ and $D_2 = 12.00$, the result will be 0.330548 pipes, 12 in. in diameter as equal to one 8-in. pipe. Then for five 8-in. parallel lines, we will have the equivalent of 1.65274 pipes, 12 in. in diameter.

Let $N_2 = 1.65274$, the equivalent number of 12-in. lines in the section; and $N_1 = 5$, which in this case is the actual number of 8-in. lines. Then by Equation (15), we have for the 12-in. line:

$$h_2 = \frac{5181\ (f\mu)_2\ B_2^2\ M}{2g\ 12^5\ N_2^2}$$

and for the 8-in. line:

$$h_1 = \frac{5181\ (f\mu)_1\ B_1^2\ M}{2g\ 7.981^5\ N_1^2}$$

Now, if we cancel the like terms in both equations and divide the first by the second, if the result is unity,

$$\frac{h_2}{h_1} = \frac{(f\mu)_2\ 7.981^5\ N_1^2}{(f\mu)_1\ 12^5\ N_2^2} = 1$$

the equivalent size of the pipe used is simply a matter of choice. To prove whether this statement is mathematically correct, it will be necessary to analyze further this last equation.

We find in computing the argument for both sizes of line, if we assume:

$$B = 4000$$

$$K = 0.10$$

then for the 8-in. size of line we have:

$$\frac{B}{DKN} = \frac{4000}{7.981 \times 0.10 \times 5} = 1002.4$$

and for the 12-in line:

$$\frac{B}{DKN} = \frac{4000}{12 \times 0.10 \times 1.65274} = 2016.8$$

The corresponding values of $(f\mu)$ taken from the graph are .02589 for the 8-in. and .02174 for the 12-in. pipe, and when inserted in the above equation, we have:

$$h = \frac{.02174 \times 7.981^5 \times 5^2}{.02589 \times 12^5 \times 1.65274^2} = 1$$

which proves the statement that the equivalent size of the pipe used for the basis of computations is simply a matter of choice.

Now if we consider this N as a function of the length M, or M/N^2 as the equivalent length of a given size of line for each section of the station district, we are absolutely correct. But if we add these equivalent lengths of each section together for the equivalent length of the entire station district, we are very seriously in error. Such procedure is a serious mistake when used in the Chezy formula, as will now be demonstrated.

Let us consider a station district of three sections. The total friction head by the Chezy formula, Equation (15), becomes:

$$h = \frac{5181\,(f\mu)_1\,B^2\,M_1}{2g\,D^5\,N_1^2} + \frac{5181\,(f\mu)_2\,B^2\,M_2}{2g\,D^5\,N_2^2} + \frac{5181\,(f\mu)_3\,B^2\,M_3}{2g\,D^5\,N_3^2}$$

combining:

$$h = \frac{5181\,B^2}{2g\,D^5}\left((f\mu)_1 \frac{M_1}{N_1^2} + (f\mu)_2 \frac{M_2}{N_2^2} + (f\mu)_3 \frac{M_3}{N_3^2} \right) \quad . \quad . \quad . \quad . \quad (16)$$

The value of $(f\mu)$ for each section is different, since the argument B/DKN is different for each section on account of the three values N_1, N_2, and N_3.

If we add the three values of (M_1/N_1^2), (M_2/N_2^2), and (M_3/N_3^2) together, as has been the practice for the equivalent length of a given size pipe for the entire station district, we have no possible way of determining the proper value of $(f\mu)$ to substitute for the three values of $(f\mu)_1$,$(f\mu)_2$, and $(f\mu)_3$ taken from the graph.

Is it any wonder that we usually get a different value of $(f\mu)$ for each station district when the discharge B and viscosity K are identical? This is, no doubt, one of the principal reasons for having such a generous assortment of the values of $(f\mu)$ for each value of the argument. The experimental values of $(f\mu)$ are also affected the same way if $\frac{2n+x}{n}$ is taken as the square root of the fifth power to determine on the basis of the carrying capacity, the number of pipes of one size equivalent to that of any other size.

In a system of parallel lines, with two or more sections in the station district, fairly accurate experimental values of the friction factor $(f\mu)$ could be obtained if the elevation of the hydraulic grade line were known at each gate plant, provided of course we knew the correct value of $\frac{2n+x}{n}$ to use in determining the number of lines of a chosen diameter for the several parallel lines in each section between the gate plants.

Hagen Formula

In the Hagen formula we find an entirely different condition, as the following demonstration will show. The total friction head, Equation (5), for a station district of three sections may be written as:

$$h = \frac{Abk^w\,B^n\,M_1}{2gD^{2n+x}\,N_1^n} + \frac{Abk^w\,B^n\,M_2}{2g\,D^{2n+x}\,N_2^n} + \frac{Abk^w\,B^n\,M_3}{2g\,D^{2n+x}\,N_3^n}$$

in which the values of A, b, k, B, $2g$, and D are the same in each section of the district, hence we find for the complete equation after combining:

$$h = \frac{Abk^w\,B^n}{2g\,D^{2n+x}}\left(\frac{M_1}{N_1^n} + \frac{M_2}{N_2^n} + \frac{M_3}{N_3^n} \right) \quad . \quad . \quad (17)$$

for use in a system of parallel lines. It is seen that the equivalent length of each section, as shown in parenthesis, may be added together for the equivalent length of the entire station district.

To determine the experimental values of the roughness factor b, we find it impossible, since the true values of the exponents x, n, and w are also not known for the experiments to be analyzed. With such an empirical equation of four unknown factors, we must have experimental data, as will be mentioned later, if we are to determine the four unknown factors.

All other pipe flow formulae developed since 1775, are either an adaption of the Chezy or the Hagen formulae.

All pipe flow experiments on single-line flow that have been published up to date, that can be classed in the same category as crude oil and gasoline flow in steel pipes, with the exception of the work of three or four experimentors, are not complete in all the required factors that enter into the resistance to flow. These are too few to undertake the analysis for determining the true law of flow of liquids in pipes.

The time now seems ripe for such an undertaking if the petroleum pipe line engineers of this country will start making scientific experiments on single lines of each size of pipe according to the same requirements of accuracy and plan of procedure.

The writer will in a short time have an article to offer along this line of thought that will give some idea of the accuracy that may be obtained.

There are other valuable equations in the solution of problems that frequently arise in the operation and design of a pipe line system. There are, however, certain conditions that must be particularly known when computing the discharge for reduced pressures; that is, the location of the hydraulic gradient throughout the entire station district. If the hydraulic gradient falls below any of the intermediate points, then a new condition exists in which this point becomes the new distance that the oil is pumped.

In any system of piping if the discharge is known for a given effective or friction head, viscosity, and length of line, it can be seen in Equation (9) that the discharge varies directly as the $1/n$ power of the head h and inversely as the w/n power of the kinematic viscosity k expressed in centipoises.

If the operating pressure is 650 lb. per sq. in. and there is an increase in the temperature of the flowing oil, there are two elements that will cause an increase in the discharge, namely, the increase in the available friction head and the decrease in the viscosity.

Consider now, the temperature remaining constant. Then the change in discharge due to a change in the effective head will be:

$$B_1 = B\left(\frac{h_1}{h} \right)^{\frac{1}{n}} \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (18)$$

in which:

B = present discharge for head h

B_1 = new discharge for head h_1

In the event the original computations were made for summer pumping and it is desired to know the discharge for some other temperature at the same pumping pressure, the new discharge will be affected by a change in the effective or friction head due to a change in the observed gravity for the new temperature as well as the change in the viscosity. This difference in discharge follows the following law:

$$B_1 = B \left(\frac{h_1}{h} \times \frac{k^w}{k_1{}^w} \right)^{\frac{1}{n}} \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (19)$$

where B, h, and k are the present values and B_1, h_1, *and* k_1 are the new values in which h_1 and k_1 are determined from the change in the temperature of the oil.

Table of Pipe Sizes and Equivalent Number of 12-in. Lines

Nominal Diameter In.	Nominal Pressure Lb.	Weight per Ft.	Internal Diameter In.	Equivalent Number of 12-in. Lines	Equivalent Number of 12-in. Lines
(1)	(2)	(3)	(4)	(5)	(6)
16a	439	62.579	15.250	2.60828	1.91667
16b	586	82.771	15.000	2.44141	1.83249
15a	469	58.573	14.250	1.98854	1.59433
15b	703	86.734	13.875	1.78734	1.48300
14a	502	54.568	13.250	1.48641	1.30860
14b	628	67.741	13.0625	1.40404	1.25895
12a	485	43.773	12.090	1.03034	1.02049
12b	551	49.562	12.000	1	1
12c	735	65.415	11.750	0.91924	0.94446
10a	487	31.201	10.192	0.52037	0.64195
10b	535	34.240	10.136	0.50899	0.63242
10c	637	40.483	10.020	0.48612	0.61296
10d	739	46.760	9.902	0.46362	0.59357
8a	544	22.361	8.125	0.21017	0.34698
8b	601	24.696	8.071	0.20464	0.34076
8c	700	28.554	7.981	0.19566	0.33055
6	792	18.974	6.065	0.06525	0.15690

In the two above Equations (18) and (19), they are mathematically true, but only apply in cases where the hydraulic gradient is known to be on top of, or outside of, the pipe.

The above table was computed by Equation (10) for both streamline flow (column 5) and turbulent flow (column 6) using the writer's values of the streamline and turbulent flow exponents. It is suggested as a very useful form of a table for parallel line flow computations. However, the values in columns 5 and 6 should not be taken seriously as having any scientific value.

In some of the existing pipe line systems, at times when pumping at a greatly reduced pressure, there is both turbulent and streamline flow in the same district. This condition may exist where there is considerable difference in the equivalent number of 12-in. lines in the several sections that make up the station district.

There is one very important thought that should be deeply embedded in every pipe line engineer's mind, that is: The most efficient pipe line system is one in which the hydraulic gradient is straight throughout the entire station district, or we may say, the equivalent number of 12-in. lines in each section are the same.

The increased carrying capacity due to an additional loop depends entirely upon where the loop is located. The writer has in mind one station district where the drop in head is very rapid in the first section, then it is very light in the next three sections due to so many loops on the low-pressure end. It is like pumping oil into one end of a lake and letting it run out at the other end. This condition was first brought about by laying low-pressure 12-in. pipe too close to the station pumping.

A continuation of this article dealing with the application of the formulae herein given, and the permissible errors in pipe flow experiments, will appear in later issues.

Correction: On p. 80, August issue, K^w in Equation (9) should be k^w.

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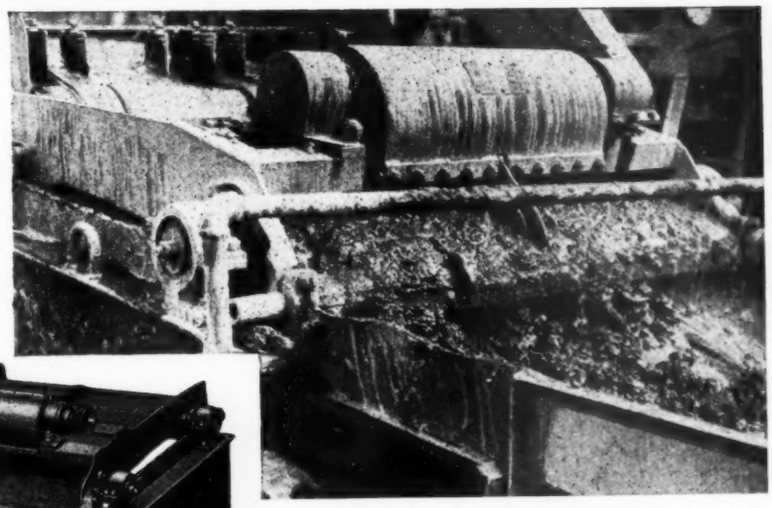

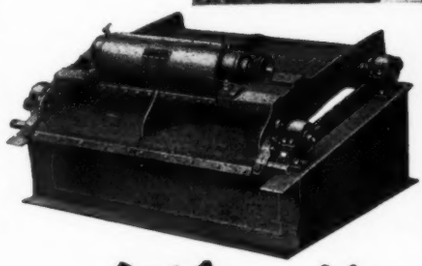

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FEDERICO RAMOS RUIZ, petroleum engineer with the Yacimientos Petroliferos Fiscales, Buenos Aires, Argentina, South America, spent some time in the Mid-Continent during August. Ramos Ruiz will be in the United States several months studying latest production practices, particularly the gas-lift.

GEORGE L. YATES of Bartlesville, Oklahoma, will become instructor in petroleum engineering at the University of Pittsburgh this fall, succeeding **LEO R. NUHFER,** who has resigned to take a position with the Peoples Gas Company of Pittsburgh.

FRANCISCO C. PLATZ, petroleum engineer with the Yacimientos Petroliferos Fiscales at Chubut, Argentina, South America, was on a visit to the Mid-Continent fields during August. Mr. Platz has been in the United States for several months observing modern drilling methods and equipment.

WILLIAM J. KEMNITZER, petroleum technologist, has been appointed technical advisor to the California Senate committee investigating tideland drilling on state oil lands. **SENATOR CULBERT OLSON,** chairman of the committee, made the appointment.

M. G. ENSINGER, general manager of the Union Wire Rope Company, Kansas City, Missouri, was married recently to **MISS MARY MATHEWS GAVIN** of Kansas City. They left the latter city August 27 for New York from where they sailed September 6 on their honeymoon. Before returning they will visit England, Scotland, France, Belgium, Switzerland, Germany, Australia, Hungary, Czechoslovakia, and Italy. They will be back in the United States December 1.

GORDON GRIFFIN resigned his post with the Texas Railroad Commission and on September 16 became affiliated with Hamill & Smith, Houston, Texas.

FRED E. COOPER, of the Fred E. Cooper Company, Tulsa, Oklahoma, left on a business trip to California early in September.

L. D. ARMSTRONG, general sales manager of the Gaso Pump and Burner Company, Tulsa, Oklahoma, recently returned from a month's vacation in Colorado.

J. M. McNEAL, sales manager in England and Continental Europe for the Landis Machine Company, is visiting the home office at Waynesboro, Pennsylvania. While in the United States he will attend the National Machine Tool Builders' Exposition at Cleveland, Ohio.

E. H. MOORE, of Tulsa, Oklahoma, independent oil producer, with Mrs. Moore, has returned from an extended vacation to the Pacific Coast, Hawaiian Islands, and Alaska.

J. F. ANDERSON, oil operator of Salt Lake City, Utah, has opened an office at McAllen, Texas, and will operate in that district.

W. S. JOHNSTON, of the Warner Quinlan Company of Texas, has been transferred from West Texas to Corpus Christi and will be in charge of the company's drilling operations in the Saxet field.

J. O. HARDY, production superintendent of the Shell Petroleum Corporation, has been transferred from Luling, Texas, to Corpus Christi, and will be in charge of the company's new production office at that place. **WESLEY DAVIS,** division engineer, and **L. J. LAMBERSON,** chief clerk, have been transferred from Louisiana to the new office.

J. A. MacKINNON, formerly with the Globe Refining Company at McPherson, Kansas, and the Sparco Refining Company at Shreveport, Louisiana, has been made general superintendent of Solvex Refineries, Inc., at Gladewater, Texas.

B. SIKES, Mid-Continent manager for the Baroid Sales Company, was the principal speaker at the August 30 meeting of the Ada, Oklahoma, Chapter of the American Petroleum Institute. He addressed the gathering on the subject "Mud Problems in the Fitts Pool."

J. F. CORCORAN, special representative, Trimont Manufacturing Company, Roxbury (Boston), Massachusetts, is back at his Tulsa, Oklahoma, office following a two months' trip to the factory and eastern cities.

WILLIAM HARRIS of Mission, Texas, has been made manager of the Woodsfield Pipe Line Company, which company has a gathering system in the Sam Fordyce field, succeeding **NELSON P. WIMBERLY,** who is now connected with the Valley Pipe Line Company.

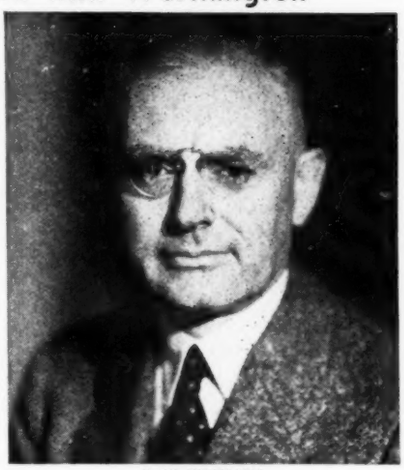
W. M. IRISH, president of the Atlantic Refining Company, has returned from a European trip. He was accompanied by Mrs. Irish.

J. S. ABERCROMBIE, Houston, Texas, independent operator, is spending his vacation in California.

JOHN A. SLEETH, formerly supervisor of dehydration operations for the Union Oil Company of California, has been made chief gauger of the transportation and field departments.

E. L. DECKER, of the Martin-Decker Corporation, Long Beach, has returned to California following a trip through the Mid-Continent and Gulf Coast areas.

J. H. Brown with Worthington



J. H. BROWN

Announcement has been made that J. H. Brown, formerly eastern sales manager of Sullivan Machinery Company, has joined Worthington Pump and Machinery Corporation as regional manager of its mining and construction division, covering the midwestern territory, with headquarters in Chicago.

Brown is a graduate of Massachusetts Institute of Technology, class of 1905. During the NRA period he served as a member of the Code Authority of the Compressed Air Institute. Widely known in construction and mining circles, he brings to Worthington a long experience in the manufacture and sale of equipment for these fields.

Shand and Jurs Company Appoint Representative

Shand and Jurs Company, Berkeley, California, has appointed as its representative for Oklahoma and Kansas the B. & C. Specialty Company of Tulsa. T. M. Christley, formerly of the Shell Petroleum Corporation, is the manager.

Mid-Continent Supply Opens Stores at Kermit and Refugio, Texas

The Mid-Continent Supply Company, general offices Fort Worth, Texas, recently opened two new stores, one at Kermit, Texas, with R. L. McAnally store manager, and under the supervision of R. C. Tucker, Odessa, district manager; and one at Refugio, Texas, with G. A. Wead store manager, and under the supervision of D. H. Thornbury, at Houston, Texas, vice-president.

Paul Cavins Makes Tour of Mid-Continent

Paul Cavins, president of The Cavins Company of Long Beach, California, has just returned from a six weeks' tour of the Oklahoma, Kansas, and Texas oil fields in the interests of his company; spending considerable time out in the fields with various of the company's branch representatives.

The Cavins Company manufactures the Cavins Hydraulic-Suction Bailer, Fishing Tool, and Perforation Washer, and has distributing and service branches in Bakersfield, Goleta, Taft, and Santa Paula, California; Houston, Kilgore, and Pampa, Texas; Oklahoma City, Oklahoma; and Wichita and Lyons, Kansas.

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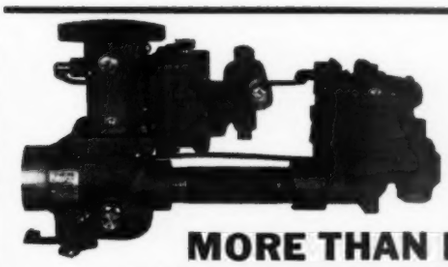

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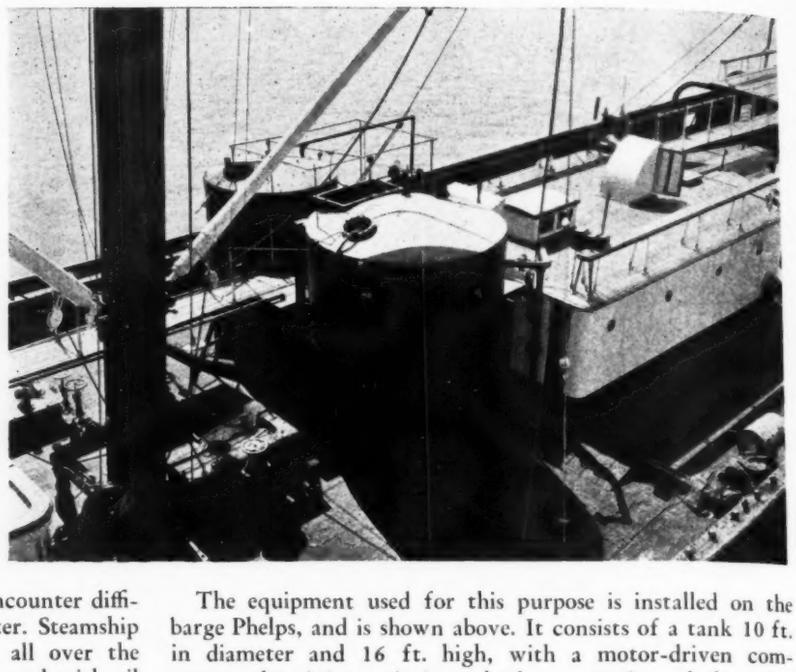


OIL companies are not the only ones who encounter difficulties due to the mixing of oil and water. Steamship companies have trouble with port authorities all over the world because ballast and bilge water contaminated with oil pollute the harbors and beaches for miles, and each port has severe restrictions governing the dumping of this contaminated ballast water in its territorial waters and harbors.

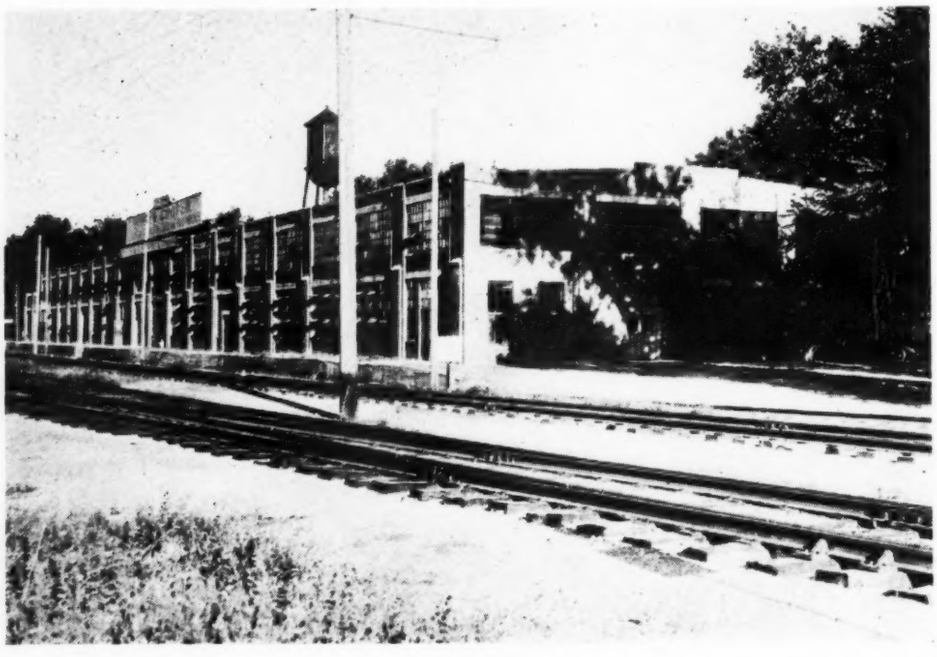
Unlike the water-in-oil emulsions usually encountered in the oil fields, those that cause the shipping industry so much trouble are of the oil-in-water type, formed when sea water is pumped into empty fuel tanks for ballasting purposes. As ridding the ship of such ballast is not a simple matter, the seriousness of the problem is readily apparent.

Several years ago this matter was referred to Petreco and the company made quite an extensive investigation of the problem. An entirely new process was developed for the purpose of treating ballast water on board ship before dumping, which would eliminate the various troubles previously encountered by the steamship companies. The process has been in service at Los Angeles Harbor for more than two years and has given complete satisfaction to both port authorities and the shipping companies.

The equipment used for this purpose is installed on the barge Phelps, and is shown above. It consists of a tank 10 ft. in diameter and 16 ft. high, with a motor-driven compressor that injects air into the lower portion of the tank. Separation of the oil and water is accomplished with the aid of compressed air, the throughput ranging from 450 to 750 bbl. per hour. Larger capacity can be provided through multiple units.

All the Dollar Line ships coming into Los Angeles Harbor have been serviced by this method over a period of 18 months, approximately 125,000 bbl. of ballast water having been disposed of for them in this manner. This service usually results in the purchase here of an equivalent amount of fuel oil which otherwise might be taken on at some other port.

It is anticipated that shortly other ports will avail themselves of this process. This method of separation also has possibilities of proving advantageous in disposing of oil contaminated waste waters from refineries and other sources. The company has patents pending on the process.



Fred E. Cooper Company Occupying New Plant

The Fred E. Cooper Company is now occupying its own factory building at Hale Station in Tulsa, Oklahoma. The plant, formerly occupied by the Compression Tube Company, has been completely remodeled and modernized.

The concern, of which Fred E. Cooper is the head, manufactures and distributes oilfield equipment to all parts of the world. Approximately 50 persons are employed.

Titusville Acquires New Account

The Titusville Iron Works Company at Titusville, Pennsylvania, manufacturers of boilers, engines, and oilfield equipment, has acquired the manufacturing and sales rights on the Master line of scrubbers and separators, except in the State of California.

The Master line is well known on the west coast, where it has been a leader for some time. The line comprises: Gas and oil separators, steam scrubbers, gas scrubbers, oil scrubbers, oil and water separators, oil-gas-sand-water scrubbers, feed water heaters, and water heads.

New descriptive literature covering the Master line is available by addressing The Titusville Iron Works Company at Titusville, Pennsylvania.

Republic Steel Opens Sales Office at Kansas City

Opening of a new sales office at 622 Dwight Building, Kansas City, Missouri, effective September 1, is announced by N. J. Clarke, vice-president in charge of sales, Republic Steel Corporation, Youngstown, Ohio. The new office is in charge of Robert L. Pierce, of the St. Louis district sales office. The telephone number is Harrison 0925.

Shand & Jurs Advance Purchasing Agent

Shand & Jurs Company, Berkeley, California, manufacturers of petroleum storage tank fittings, announce the promotion of Eugene E. Jurs, purchasing agent, to the position of assistant to the manager of their eastern offices in New York.

Eugene E. Jurs is the son of Albert Jurs, prominent West Coast engineer and president of Shand & Jurs Company. After leaving Stanford University, Mr. Jurs served a full apprenticeship in the shops of the company and was finally placed in charge of purchases.

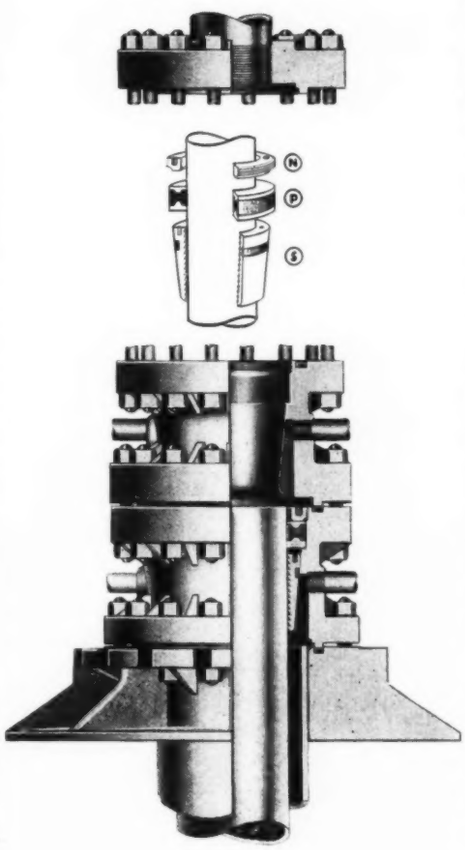
On his trip east Jurs stopped at Des Moines, where on August 30 he was married to Miss Florence Le Cron, daughter of J. D. Le Cron, assistant to the secretary of agriculture. After a honeymoon in New England, Mr. and Mrs. Jurs will reside in New York.

This is a FACT!

The

SHAFFER SPOOL HEAD

LANDS CASING EASIER, QUICKER AND WITH LESS RISK THAN ANY OTHER METHOD!



To land casing first take stretch and set slips "S" and cut off the casing flush with top of head. Packing assembly "P" rests in a recess in the head above the slips and is tightened down by compression nut "N". Bolt on flange to which drilling connections are attached and resume drilling.

This method eliminates letting go casing and setting on bottom with attendant risks. It also eliminates time lost in procuring the right length nipple and the risk and difficulty of unscrewing at the wrong place in the string. Used without special tools. No failure of packing has ever been reported even in case of fire.

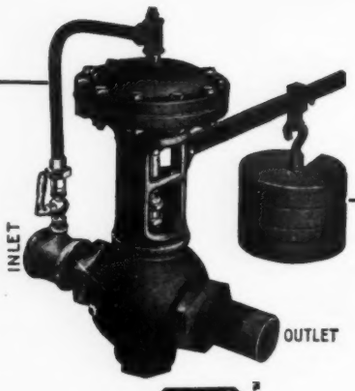
Illustration shows complete ensemble in which two strings of casing are supported, all resting on the Shaffer Landing Base. The landing base has an extended top flange which has slots for receiving the bottom end of the tie down rods. The base plate is welded to the surface string and is grouted underneath to a level position. It carries the load of all pipe, but each set of slips carries only the weight of one string of pipe.

Many of the longest and heaviest strings of casing in the world have been carried on Shaffer Spool Type Heads.

SHAFFER TOOL WORKS

BREA, CALIFORNIA — HOUSTON, TEXAS

EXPORT—OIL WELL SUPPLY COMPANY



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Compressor Regulator

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EXCESS discharge pressure is relieved, discharge kept constant, and operation of the compressor at full speed made safe, by use of the C-F Compressor Regulator. As a close regulator of pressure on electric-driven pumps, it stands unrivalled. Gas, steam, air, water—in all such applications the C-F Compressor Regulator is thoroughly dependable. The lever type is here shown. A spring-loaded valve is also available and is equally sure in operation. Excess discharge pressure flows through without noticeable variation in suction line. Ask for descriptive pamphlet, also Catalog of Chaplin-Fulton regulators for all requirements of gas-pressure control.

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28-40 Penn Avenue Pittsburgh, Pa.

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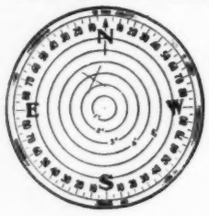
PHOTO-RECORD
MAGNETIC SINGLE-SHOT SURVEY INSTRUMENT

For Measuring Both INCLINATION and DIRECTION of Drilling Wells — With Accuracy and Ease of Operation.

INTERCHANGEABLE INCLINATION UNITS

A single instrument equipped with this exclusive Anderson feature provides the closest possible reading throughout any range of inclinations. The Inclination Units are supplied for maximums of 5°, 10°, 25°, and 65°. To the left is shown, in reduced size, a completed record made with a 5° Unit. The Inclination of 2° 35′ and Direction of N. 21° E. is easily read.



Send for Bulletin No. 11-A

ALEXANDER ANDERSON, Inc.
FULLERTON, CALIFORNIA

Branch Offices
LONG BEACH SANTA BARBARA BAKERSFIELD

SURVEYORS OF OIL WELLS SINCE 1924

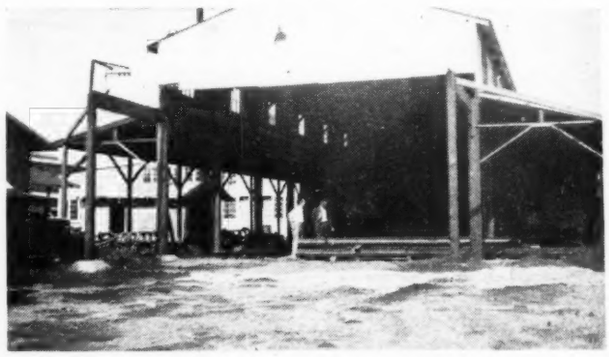
O. Hammer Visits Mid-Continent and Gulf Coast Fields

O. Hammer, superintendent and engineer for the Security Engineering Company, Whittier, California, recently spent two weeks in the Mid-Continent and Gulf Coast oil fields. He conferred with the Mid-Continent distributors of the Sievers Reamer, the Wilson Supply Company, and spent some time among the operating companies regarding reaming equipment.

O. HAMMER

MacClatchie Company Enlarges Plant

Having entered the liner manufacturing field, the MacClatchie Manufacturing Company has found it necessary to construct a large steel shed at its Compton, California, plant. This company has patents that permit it to build a liner out of special alloy seamless tubing, which, when properly heat treated and hardened, the manufacturer claims makes one of the hardest wearing surfaces of any hardened ground liners.



The manufacturer also states that they build special grinding machines in order to get the best possible ground finish on the bore of the liners by utilizing tubing for the construction of these liners. The price has been materially reduced, it is pointed out.

The building shown in the accompanying illustration is used for storing and handling the large quantity of tubing required in the manufacture of this liner.

Frank Champion on Trip for BJ

Frank Champion, general sales manager for the Oil Tool Division of Byron Jackson Company, left Los Angeles on August 16th to cover the Mid-Continent and Eastern fields in behalf of BJ, and will return to Los Angeles around November 1st.

Champion plans to relieve C. F. Vincent, Mid-Continent manager for Byron Jackson Company, with headquarters at Fort Worth, while Vincent enjoys an extended vacation trip through the East, and covers the Michigan territory.

Supervising Enlargement D+B Plant at Dallas

CHARLES D. WAGNER

Charles D. Wagner, vice president and manager of the D+B Pump and Supply Company, Los Angeles, and E. E. Stevenson, chief engineer, are in Dallas, Texas, to supervise the construction of the $100,000 addition to the D+B manufacturing plant in the latter city.

The expansion plans include installation of the latest precision machines for the manufacture of D+B pumps, fittings, and sucker rods, as well as additional service shops in various of the major oil fields in that territory.

The enlarged facilities of the Dallas organization will increase the production capacity sufficiently to meet all requirements of oil companies in the Mid-Continent, Texas, and Gulf Coast fields during the next few years, and enable a much closer contact of the manufacturing, service, and sales departments with the users of D+B products, resulting in correspondingly better service to those users, officials of the organization point out.

Charles R. Parker Now With Pittsburgh Equitable-Merco Nordstrom

Announcement has been made that Charles R. Parker, former geologist and contracting driller in the Mid-Continent area, has joined the sales force of the Pittsburgh Equitable Meter Company and its subsidiary, the Merco Nordstrom Valve Company.

Parker, who served in the navy during the World War, has a background of technical training and a wealth of field experience that should stand him in good stead in his new work. He received his engineering education at Kansas University, later attending the University of Oklahoma to specialize in geology. Thereafter he worked for a period as geologist with the White Eagle Oil and Refining Company, leaving in 1925 to become associated with his brother in the Parker Drilling Company as oilfield contractors. More recently Parker was connected with the production department of the Barnsdall Oil Company.

In his new position, he will operate from the Tulsa factory of these companies, under the supervision of District Manager A. J. Kerr. He will specialize in the sale and service of Emco gas meters and regulators, Pittsburgh oil meters, and Nordstrom lubricated plug valves.

H. A. Binford to Represent American Steel and Wire Co. in West Texas

H. A. Binford, formerly of Russell, Kansas, has been appointed to represent in West Texas the American Steel and Wire Company, Chicago, in the interest of "Tiger" brand wire lines. He has been in the supply business for many years. His headquarters are at Abilene, Texas.

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WATER CANS & COOLERS
Pure... clear drinking water
When you have a GOTT Water Cooler handy, you will always be assured of a fresh supply of pure drinking water kept delightfully cool. Order one from your supply store... now!
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H.P.GOTT MFG. CO., Winfield, Kansas
KEEP PURE DRINKING WATER ALWAYS HANDY

THE *Standard* WATER CAN OF THE PETROLEUM INDUSTRY

LUFKIN TAPES
"Atlas"
The World's Best Gauging Tape
"Challenge"
for Engineering, Strapping and General Measuring
Send for Catalog covering complete line
THE LUFKIN RULE CO. SAGINAW, MICH.
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Look for the Leaden Seal on Each Chain
ARMSTRONG BROS.
TESTED CHAINS... 3,600 to 40,00 pounds
These are Tongs of known strength with chains proof-tested to two-thirds catalog rating; with jaws drop-forged from special steel, hardened, tempered and tested for wearing qualities.
Handles are forged; the bolt is hardened steel; the shackle drop-forged from chrome-nickel steel. Design improvements give greater bearing on bar, provide guides for chains that prevent jamming.
Standardize on these stronger, handier tongs.
Write for Pipe Tool Catalog, just out.
This Seal marks a proof-tested Chain.
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"The Tool Holder People"
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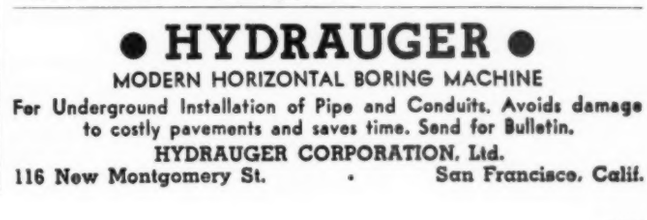
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MODERN HORIZONTAL BORING MACHINE
For Underground Installation of Pipe and Conduits. Avoids damage to costly pavements and saves time. Send for Bulletin.
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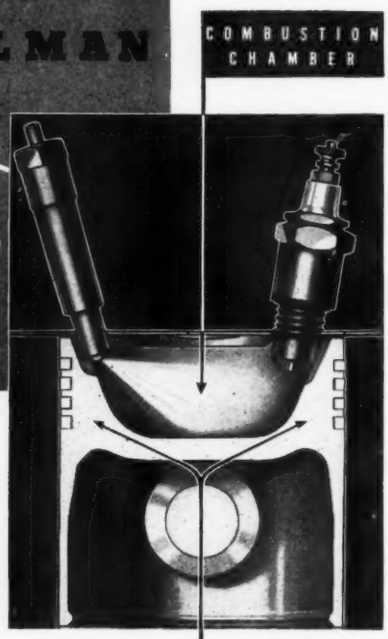
THE HESSELMAN HAS NO "Hot Spots"



The combustion chamber of the Waukesha-Hesselman Engine is formed by the concave piston head itself. The piston is a single casting. No slots separate the head from the skirt. The extra metal in the piston head, unbroken by ring grooves, conducts the heat from the head to the skirt.

The Hesselman is fitted with wet sleeve cylinders which rapidly transmit the heat of combustion to the cooling water surrounding the cylinders.

Large capacity water jackets are fed by a water pump which builds up a definite pressure to thoroughly scour valve seats and cylinder heads. Ports and passages direct cooling water in definite paths for uniformly efficient operating temperatures. A thermostat, built into the water manifold, controls the jacket temperatures.

A geared pump delivers full pressure oil to all bearings, shafts and gears within the engine, while crankcase mist flood oils the pistons and cylinders. Pressure is maintained under all conditions of oil level by the patented Oil Level Equalizer. The pressure control valve may be set without stopping the engine or disturbing any of the internal parts.

Write today for Bulletin 1000. *Waukesha Motor Company, Waukesha, Wisconsin.*

THIS IS NO. 5 OF A SERIES on the Waukesha-Hesselman Oil Engine. No. 6 will appear next month. A reprint of the complete series will be mailed on request.

NRA CODE

WAUKESHA ENGINES

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DALLAS **SAINT LOUIS** **LOS ANGELES**

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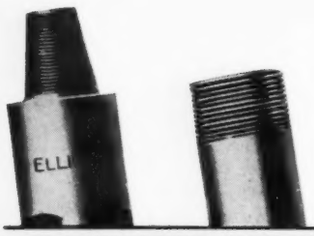

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Only the ELLIOTT *Embodies* ELLIOTT *Design*

Elliott Drill

To perform the intricate operations of cutting and recovering true samples of various formations thousands of feet underground involves certain definite requirements . . . correct design, high quality materials, precision construction. Chief among these is correct design. There are, however, varying degrees of *correct* to *perfected design.*

The first core drill . . . an Elliott, manufactured and used successfully in 1921 . . . embodied the correct principles of design, construction and operation. Yet these same principles have been developed and perfected far beyond the knowledge and ability even of Elliott engineers during those early days of oil well coring operations.

Elliott design of today not only is correct . . . through the intervening years it has been perfected to a degree that enables current models of Elliott Core Drills to function more efficiently according to modern standards than ever has been possible before. Such improvements and perfection in design can result only from long years of intensive, specialized core drilling and core drill manufacturing experience. It involves knowledge and ability, as well as patented features, that are entirely beyond duplication.

The value of Elliott design is apparent in the performance of Elliott Core Drills wherever they are used—fast hole, high recoveries of good cores and trouble-free operation with the highest margin of safety. Write for descriptive bulletin stating whether rotary or cable tools are used.

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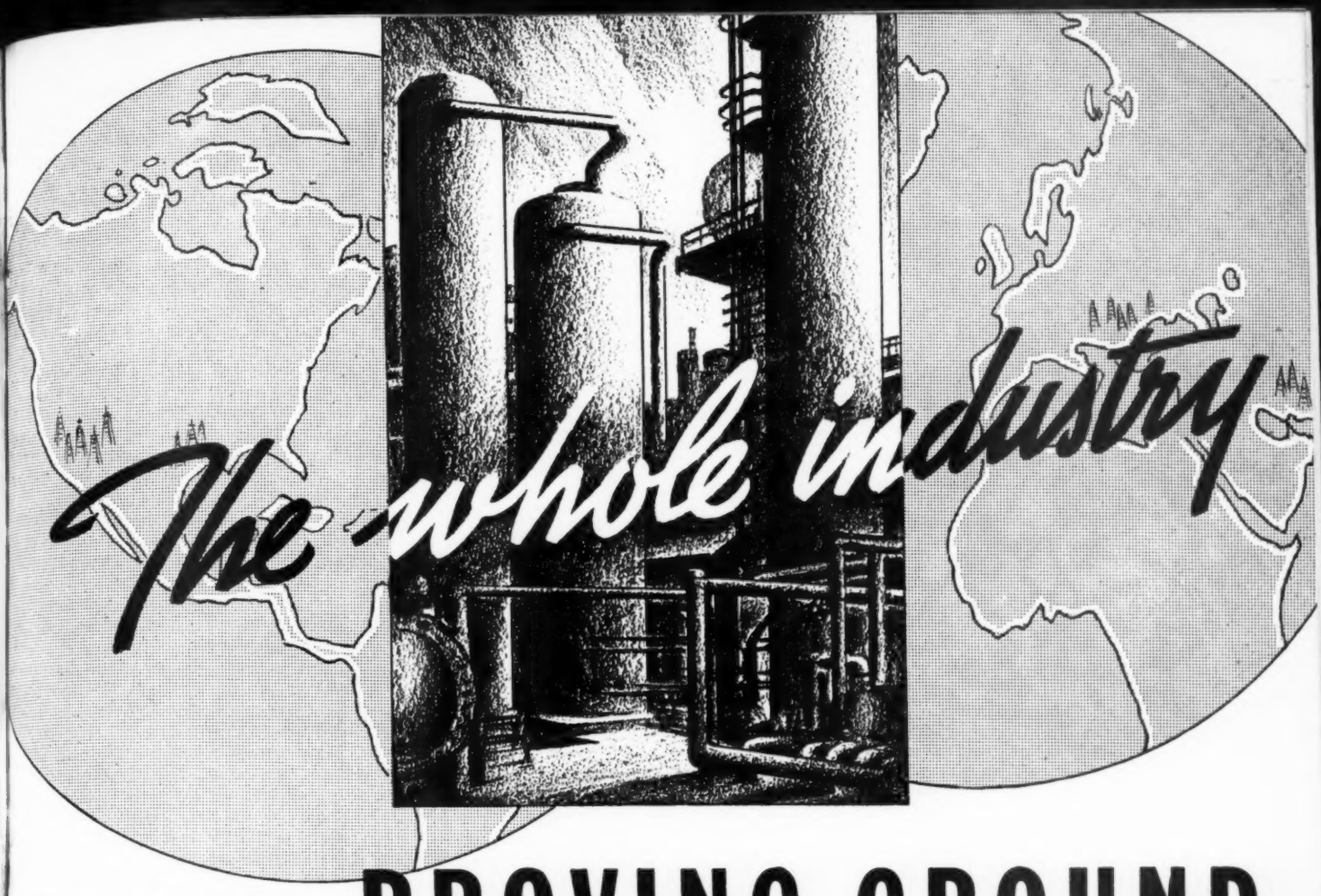
ELLIOTT *Rotary* AND *Cable Tool* CORE DRILLS



IS THEIR PROVING GROUND

In their research headquarters at Indian Orchard, Chapman metallurgists have long been drilling out the facts about corrosion, creep, abrasion and the other factors that decide the life of valves.

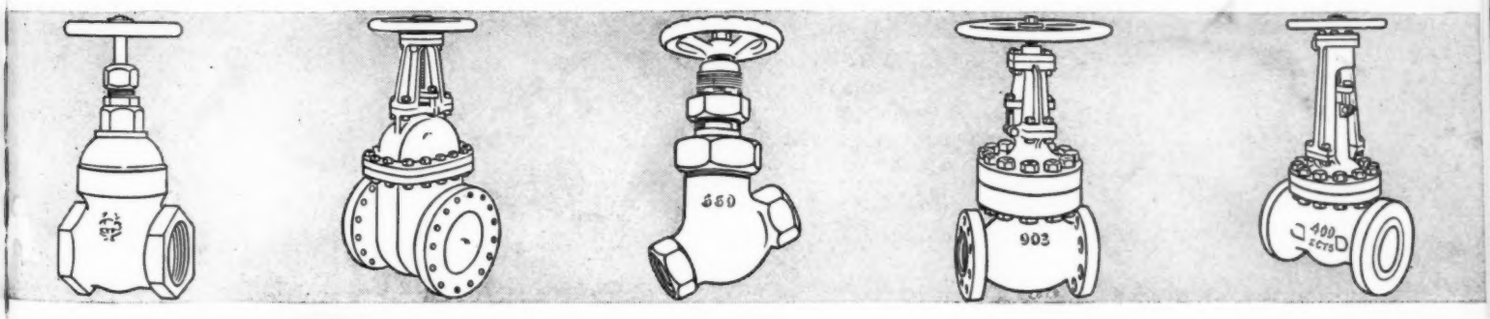
But to put those facts to work . . . *to develop valves that will last longer* . . . Chapman engineers go to the only proving ground that really counts — *the oil industry itself.* New or old, every valve in the Chapman line has had to *prove* itself not only in the Chapman laboratory but out in the field under the eyes of oil industry engineers looking for trouble. *The whole industry is the proving ground for Chapman Valves.*

Somewhere — for some other engineer — they have already proved their ability to perform under conditions exactly like your own. Specify them and you can be *sure* of trouble-free economical service.

The Chapman line is complete—gate, globe and check valves and fittings in all sizes, for temperatures from 50° below zero to 1000° F. Write for bulletin.

CHAPMAN VALVES

. . for sub-zero temperatures are the result of closest co-operation between Chapman metallurgists and oil industry engineers. They retain their strength at 50° below zero.



The CHAPMAN VALVE

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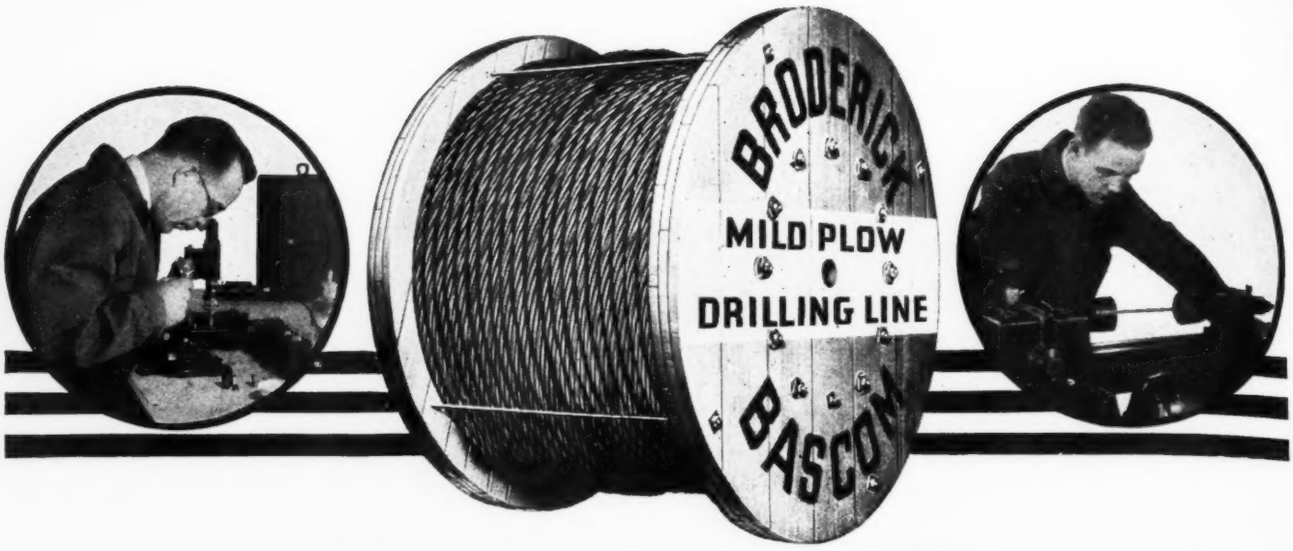
INDIAN ORCHARD, MASSACHUSETTS



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And only the best wire gets in, because only after passing the most rigid tests under the watchful eyes of our engineers, is wire rated high enough for such important use.

Fifty-nine years making nothing but wire cable has taught us how to take this super-wire, and twist it into drilling lines that give remarkable service and economy in cable tool drilling.

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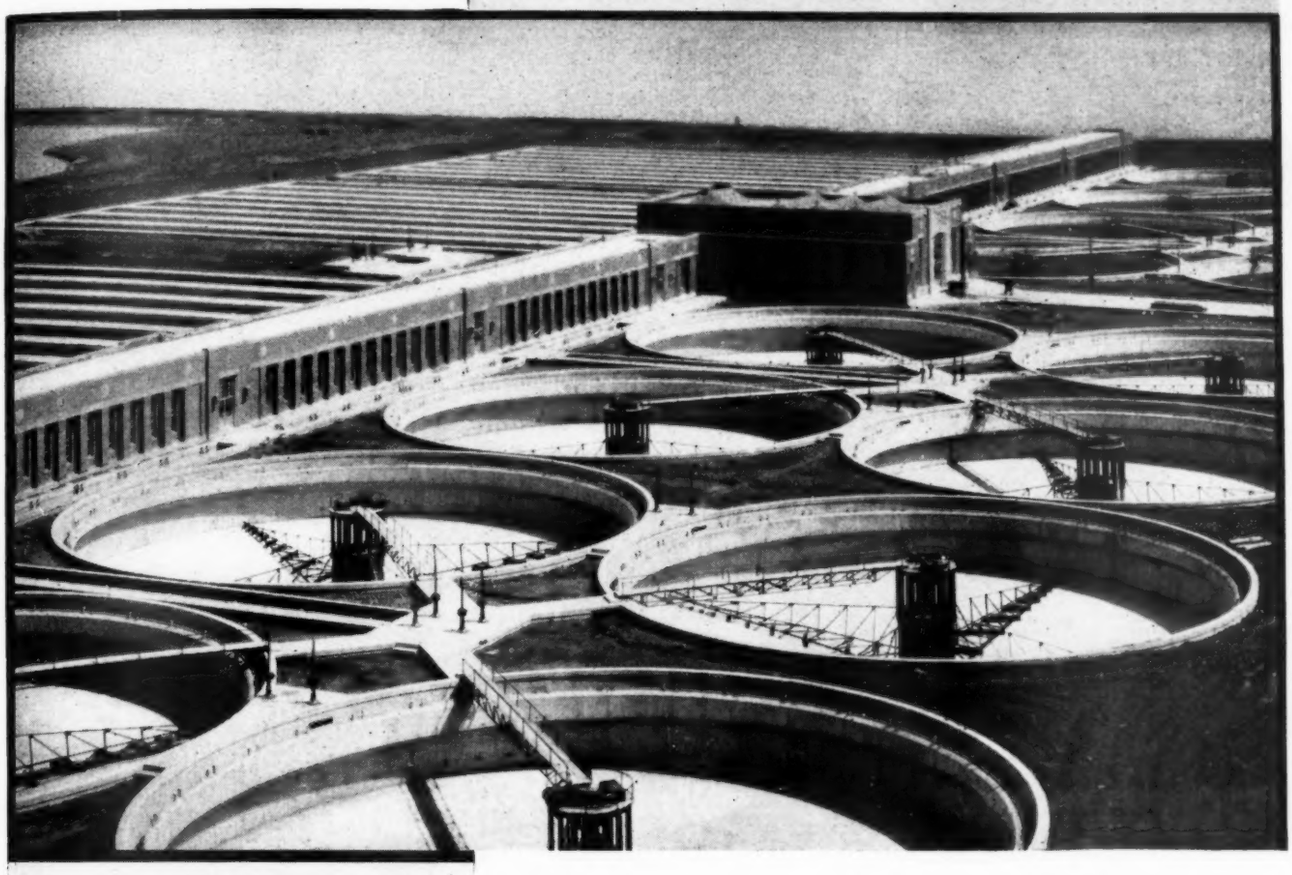
Mid-Continent Distributors
Adequate stocks in all active fields

The Petroleum Engineer, issued thirteen times a year by the Petroleum Engineer Publishing Co., 405-409 Tower Petroleum Bldg., Dallas, Texas. Subscription price, $1.00 per year, except in Canada, where the price is $1.65 per year—15 cents a copy. Entered as second-class mail matter May 1, 1932, at the post office at Dallas, Texas, under the Act of March 3, 1879.

$14,000,000 *protected against rust*

Entire steel structure of new Cleveland Sewage Plant painted with EAGLE Sublimed BLUE LEAD



A more enduring rust-inhibitive paint

• Here's why more and more engineers every year are recommending Eagle Sublimed Blue Lead as the most efficient rust-inhibitive paint for all metal surfaces:

1 Being pure lead, it is most enduring—gripping metal surfaces tenaciously. Does not chip or peel.

2 Being of extremely fine particles, it stays in suspension. Doesn't harden in container or clog the spraying nozzle. Equally satisfactory for brushing, spraying or dipping.

3 Chemically stops corrosion because of great basicity.

4 Brushes easily, flowing out like enamel. Painters like it.

5 Offers greatest economy. Lower in first cost than other high grade metal paints. Greater coverage—600 to 800 square feet per gallon. Saves 40 to 50% in material cost. Long lasting.

• You can buy Sublimed Blue Lead in paste form (pure lead ground in pure linseed oil) under the Eagle label—or in ready mixed form from reputable manufacturers. Send for descriptive booklet and free sample.

• New Easterly Sewage Disposal Plant, Cleveland, Ohio, recently completed at cost of $14,000,000. Metal surfaces were protected against rust and corrosion by Eagle Sublimed Blue Lead. Sludge bed steel equipment was also painted with Sublimed Blue Lead to guard it from strong acids of raw sewage—against which ordinary paint films cannot stand up.

EAGLE *Sublimed* BLUE LEAD

BASIC SULPHATE OF LEAD, BLUE

EAGLE RED LEAD
Rapid-drying qualities make it ideal for rush jobs

• MAIL COUPON FOR FREE SAMPLE

THE EAGLE-PICHER LEAD COMPANY, Dept. PE9, Cincinnati, Ohio.
Please send me free sample of Sublimed Blue Lead—also descriptive booklet on this more efficient rust-inhibitive paint.

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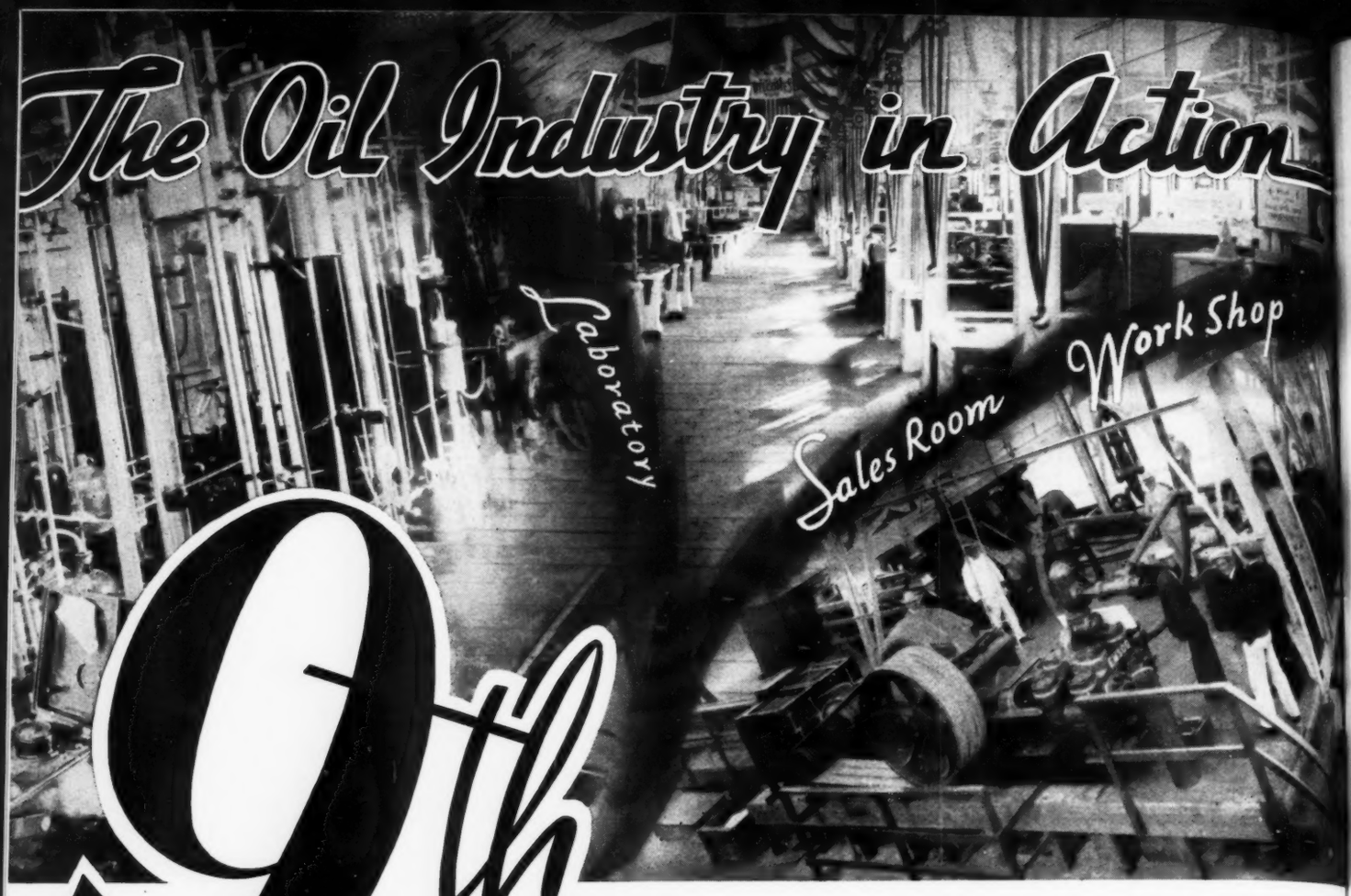

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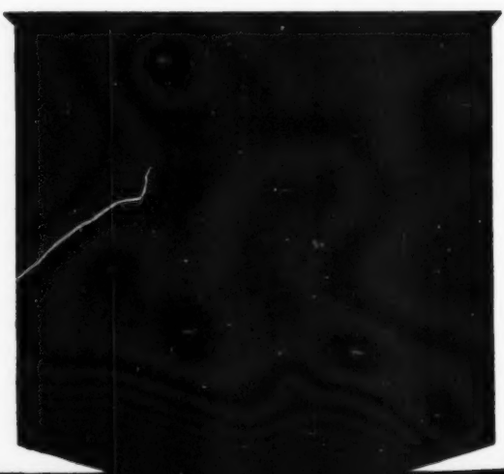
Phone, call or write today for complete information on exhibit space, rates, etc.



WM. B. WAY, General Manager

Phone 6-2171—Tulsa, Oklahoma—U. S. A

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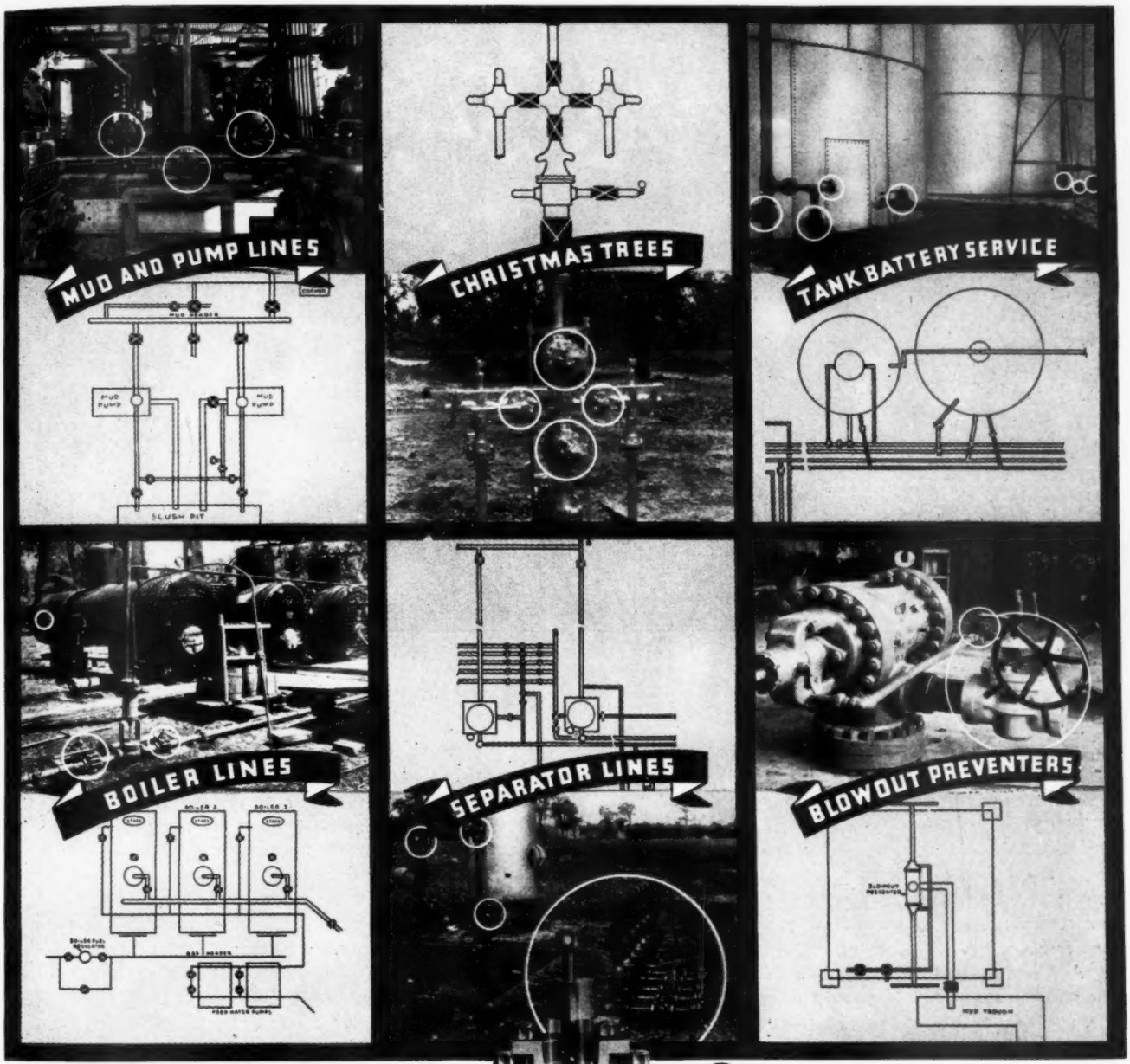
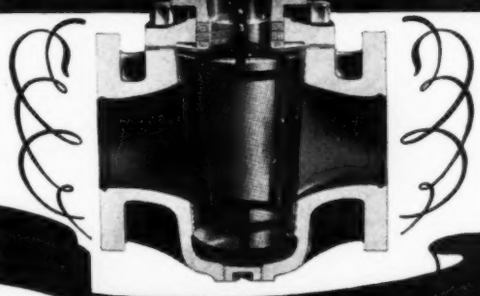


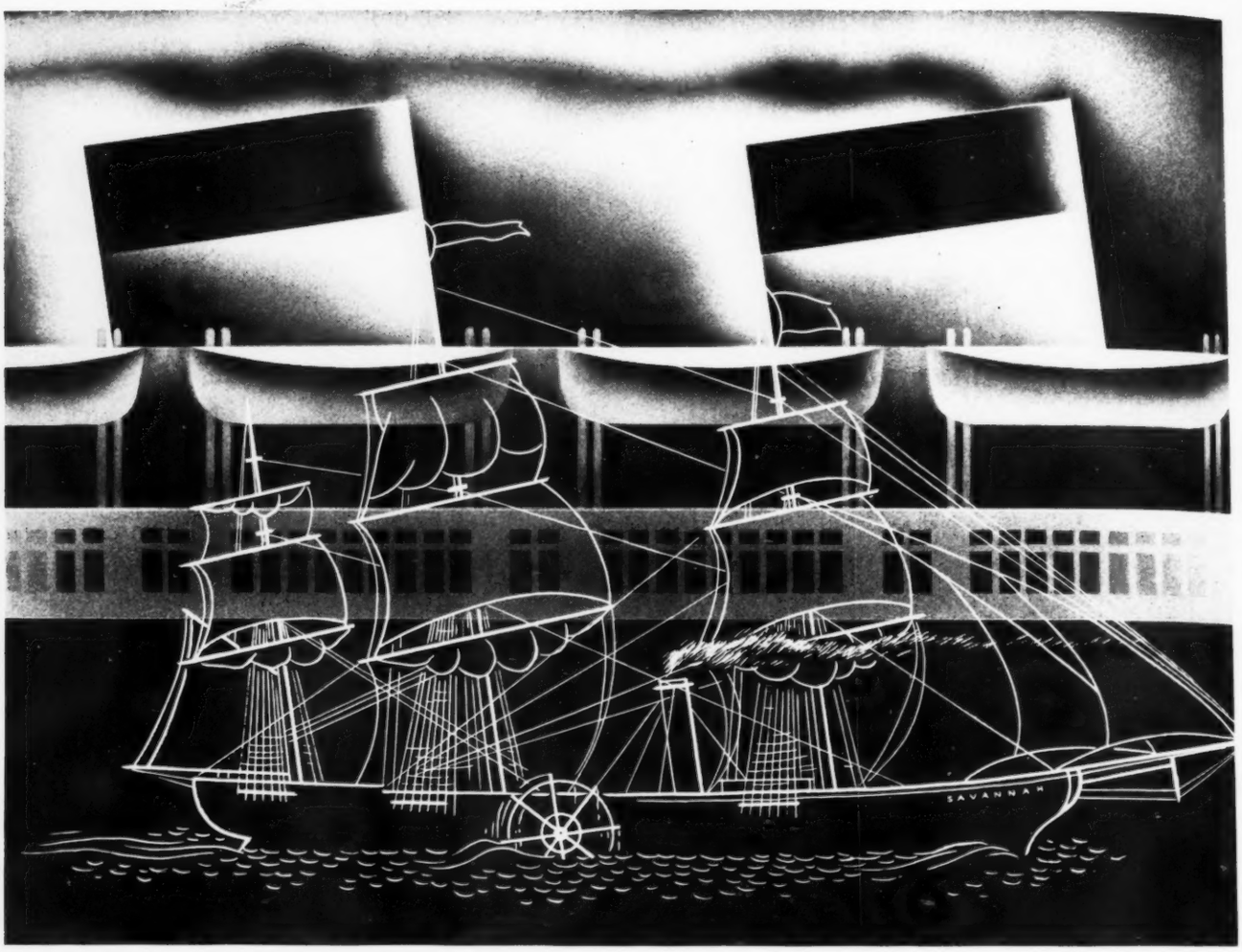
For deep drilling through high pressure formations requiring high pressure in the mud lines, Nordstrom Lubricated Valves, with "Sealdport" lubrication, are safest. They hold the mud lines tight and give several times the life of any other type of valve.

Ask for Bulletins



Nordstroms are essential on flow lines, tanks and separators—in fact all lines. Round-opening valves are offered by Nordstrom for drilling-through service.

MERCO NORDSTROM VALVE COMPANY
A Subsidiary of
PITTSBURGH EQUITABLE METER CO.
Main Offices: Pittsburgh, Pennsylvania.
Branch Offices:
New York, Philadelphia, Columbia, Chicago, Kansas City, Memphis, Atlanta, Tulsa, Houston, Los Angeles, Oakland.



Marvel of her era . . . outclassed today

WHEN the Savannah made her epic crossing of the Atlantic she was hailed as the ultimate in steam-powered vessels. Yet such succeeding queens of the sea as the Great Eastern, the St. Louis and the Deutschland reigned under the similar popular belief that the limits of size, speed, luxury and safety in ocean liners had finally been reached. Today, even while the magnificent Normandie is ushering in another epoch in ocean transportation her alert owners are giving heed to the needs and problems the future may bring.

Steamship history has many parallels. Take steel. Since the basic discoveries of Kelly and Bessemer, steel progress has been restless with change . . . less visible, perhaps, than is possible with steamships, or skyscrapers, but gradual and pronounced nevertheless. The use of element after element has been developed to improve steel's qualities or to endow it with new properties for different purposes.

Many of such alloyed steels of the past two decades have come to be regarded as "satisfactory" for the uses they serve . . . mainly because engineers, superintendents and shop foremen have become accustomed to their characteristics. Yet change — progress — is still on the march. No advance of the past decade has been more significant than that afforded by Molybdenum. Widely proved during many years and in thousands of laboratory tests, and foundry, shop and service applications, this really unique alloying element has been found capable not only of improving practically all of steel's generally desired properties, but of enabling other alloys better to serve their particular purposes.

To engineers, metallurgists and production executives we offer these interesting books: "Molybdenum in 1934" and "Molybdenum in Cast Iron — 1934 Supplement." Also ask us to mail you our periodical news-sheet, "The Moly Matrix." Be free, too, to enlist our Detroit experimental laboratory's help at any time. Climax Molybdenum Co., 500 Fifth Ave., New York.

Visit the Climax exhibit in booths K-41 and L-42 at the National Metal Exposition, Chicago, September 30-October 4.

MOLY

CLIMAX Mo-lyb-den-um

INDUSTRY'S MOST MODERN AND VERSATILE ALLOY

American Hammered Step Seal Rings purchased from the Cooper-Bessemer Corporation are giving remarkable service in these ten 1000-horsepower Cooper Gas Engines at the Munce Compressor Station of the Arkansas-Louisiana Pipe Line Company.

Piston Rings *Still Good* after travelling 178,977 Miles

...*Must be Good!*

"I THOUGHT you might be interested in knowing the splendid service your rings will give with good operators and proper lubrication."

So writes W. E. Nestor—superintendent of Compressor Stations of the Arkansas-Louisiana Pipe Line Company—who continues:

"Our engines have a stroke of six feet per revolution and operate at 125 R.P.M. or a distance of 45,000 feet per hour which multiplied by the 21,000 total hours operated gives the astounding total of 945,000,000 feet or 178,977 miles. *More than seven and one-half times around the earth's circumference!*"

The American Hammered Piston Rings, still giving excellent service as this was written (May 15th, 1935), have been in operation since October, 1929, and examination shows little wear on either rings or liners.

Here's a record we can well be proud of—and one that you can profit by.

AMERICAN HAMMERED PISTON RING COMPANY
Division of The Bartlett Hayward Company
BALTIMORE, MARYLAND

American *Hammered* PISTON RINGS

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San Francisco, Calif. 320 Market St.
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Tulsa, Oklahoma 404 E. Second St.
Winfield, Kansas

Mail today! AMERICAN HAMMERED PISTON RING COMPANY
Baltimore, Md.

Gentlemen: Please send me a free copy of your Engineers' Hand Book, and place my name on your mailing list.

*Name*_____

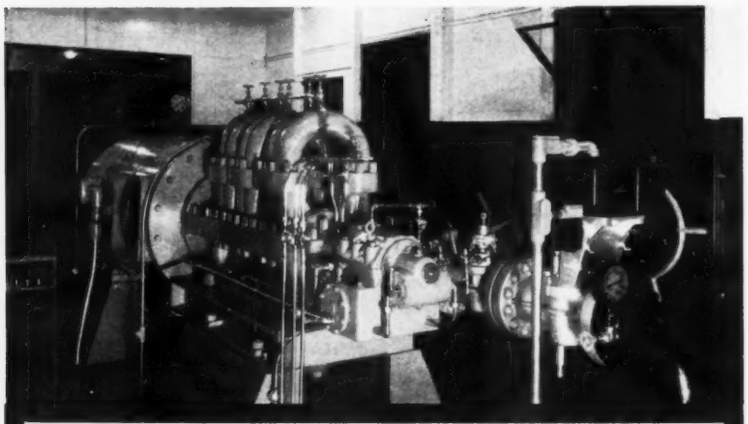
*Position*_____

*Company*_____

*Address*_____

PE-9

PURCHASED ELECTRIC POWER PUTS ITS MIGHTY SHOULDER to the GREAT LAKES PIPE LINE...



400 hp. electric motor-driven pumping unit, Clear Lake, Iowa. One of the thirty-two pumping stations, many employing as much as 700 hp., on the Great Lakes Pipe Line using purchased Electric Power.

The Great Lakes Pipe Line transports gasoline from the Mid-Continent refineries to the Great Lakes area. Along this 1500 miles of pipe line, purchased Electric Power puts its mighty shoulder to this modern wheel of progress. Thirty-two electric motor-driven centrifugal pumps total more than thirteen thousand horsepower and employ in excess of 42 million kilowatt hours annually. Economy and Dependability dictate the choice of purchased Electric Power for this and other modern pipe line projects. ASK YOUR POWER COMPANY for helpful co-operation in solving your pipe line problems.

PETROLEUM ELECTRIC POWER CLUB

Completely Balanced

NATIONAL UNIT PUMPERS

TYPE THD 600

Easily portable and especially suitable for proration tests. Adaptable to practically any type of prime mover with flat or "V" belts. Conservatively rated, rigidly supported herringbone gears ❖ ❖ Twin eccentric disc cranks with easily adjusted counterweights ❖ ❖ Positively equalized double pitman ❖ ❖ Fully inclosed, bronze bushed and oil-sealed bearings, lubricated with oil or grease ❖ ❖ Vertical lift hanger, easily removed from beam for pulling operations ❖ ❖ Welded steel frame and four leg sampson post make these pumpers strong and rigid.

THE NATIONAL SUPPLY COMPANY

STOP! READ! SAVE!

...by using this High Tensile Steel Welded Casing!

★ Hundreds of strings now in use prove the efficiency and the economy of this most recent South Chester development. Let *your* next order be for Chester High Tensile Steel Casing.

★ Can be used at depths greater than those given in any published tables for welded casing.

★ Offers new freedom from damaged threads in handling and almost entirely eliminates burnt threads in making up.

★ Has a high weld strength.

★ Chester High Tensile Steel Casing has a Brinell hardness of 140 minimum.

WRITE TODAY FOR FULL PARTICULARS

SOUTH CHESTER TUBE COMPANY, Chester, Pa.

CHESTER
HIGH TENSILE STEEL WELDED CASING

Chester also makes "Wrought Iron" pipe—manufactured from genuine old-fashioned hand puddled muck bar made in our own mills from 100% pig iron.

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J. P. Cooney, 715-716 A. G. Bartlett Bldg., Los Angeles, California.

J. P. Steele, 603 Petroleum Bldg., Fort Worth, Texas.

District Offices

South Chester Tube Co., 1708 Hudson Terminal Bldg., 30 Church Street, New York, N. Y.

J. D. Swartz, 1231 S. Evanston St., Tulsa, Oklahoma.

E. L. Moseley, 2218 Mills St., Houston, Texas.

Burt S. Shafer, Southwest Representative, 4313 Fairfax Ave., Dallas, Texas, or 603 Petroleum Bldg., Fort Worth, Texas.

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Houston, Texas; Thenard, Calif.; San Francisco, Calif.

Distributors

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International Supply Co., Tulsa, Okla., and Branches.

Dunigan Tool & Supply Co., Breckenridge, Texas, and Branches.

Bridgeport Machine Co., Wichita, Kans., and Branches.

Producers Supply and Tool Co., Marietta, Ohio; Fort Worth, Tex., and Branches.

Louisiana Supply Co., Sulphur and Brimstone, La.

Oil Field Equipment Co., San Antonio, Texas.

Okmulgee Supply Corp., Okmulgee, Okla., and Branches.

Stephen H. McCabe, 508 4th St., San Francisco, Calif.

Herley Supply Co., 3006 Cherry Ave., Long Beach, Calif.

Barde Steel Co., Seattle, Wash., and Portland, Ore.

Star Drilling Machine Co., 550 Clinton St., Portland, Ore., and Akron, Ohio.

United Pipe & Supply Corp., Charleston, West Virginia, and Branches.

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Prichard Supply Co., Manningston, W. Va., and Branches.

LeValley, McLeod, Kinkaid Co., Elmira and Olean, N. Y.

FOR PRODUCTION SWABBING

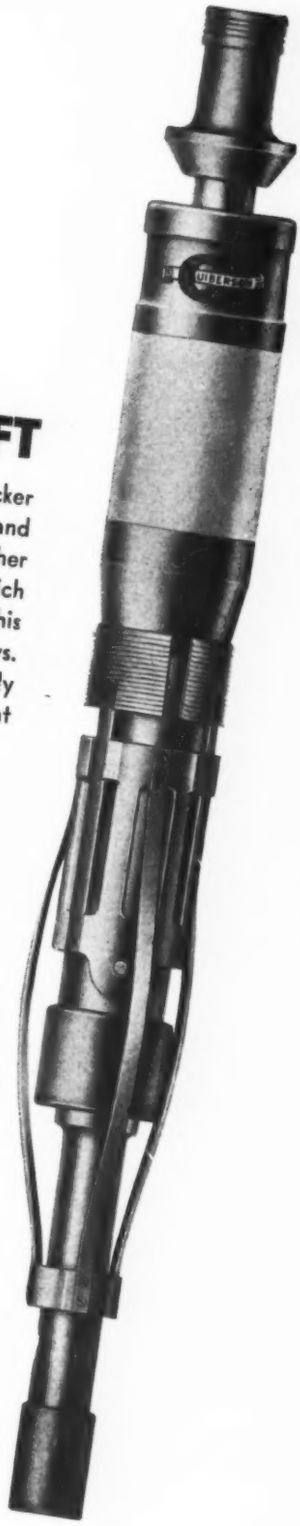
The GUIBERSON Swab revolutionized swabbing practice. Before it was introduced the swabbing of an oil well was an exception rather than the rule. Today men who formerly condemned swabbing are using the GUIBERSON Swab for bailing, scraping, agitating and producing the oil. The resilient cups will not stick—will not wear out casing. Runs of 70 days duration have been made with no perceptible wear on casing. Fully patented.

FOR AIR AND GAS LIFT

The GUIBERSON Control Head Packer is the one packer which is ideally adapted to every service, including air and gas lift. It runs in more rapidly and easily than any other packer, due to the passage between shell and tubing which is closed by the valve at top only when packer is set. This feature enables it to run in against the heaviest flows. Makes tight pack, yet is released and raised by merely raising the tubing. Can be set higher or lower at will. Patented.

FOR SAFETY OF TUBING

The GUIBERSON "Type E" Tubing Catcher was designed to protect tubing in today's deepest wells. Note the greatly increased slip area. These large slips have three times the area of earlier models, distribute the strain over the casing's inner surface, and eliminate any danger of splitting or distorting the casing. All load-carrying parts are steel. Specially developed, non-fatiguing spring, insures reliable action whenever the emergency may occur. Perfected through 22 years of service in every oil field in the world.



THE GUIBERSON CORPORATION

Box 1106, Dallas, Texas

Los Angeles: 1304 Security Title Insurance Building; Tulsa: 504 Wright Building; Houston: 1635 Norfolk Street; Ponca City: 221 South Osage Street; Newark, Ohio: First and Locust Streets.

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BETTER BE SAFE THAN SORRY

When—

Bridgeport Double-3-Point Rotary Reamers
AND
Bridgeport Long Drill Collars
are used together.

Drill Collars, all sizes, 6-12-20-24 and 30 ft. lengths, carried in stock. Longer lengths up to 55 ft. furnished on order.

All sizes of Reamers carried in stock.

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To order, to secure prices, or other information, telephone—station to station—from anywhere at any time

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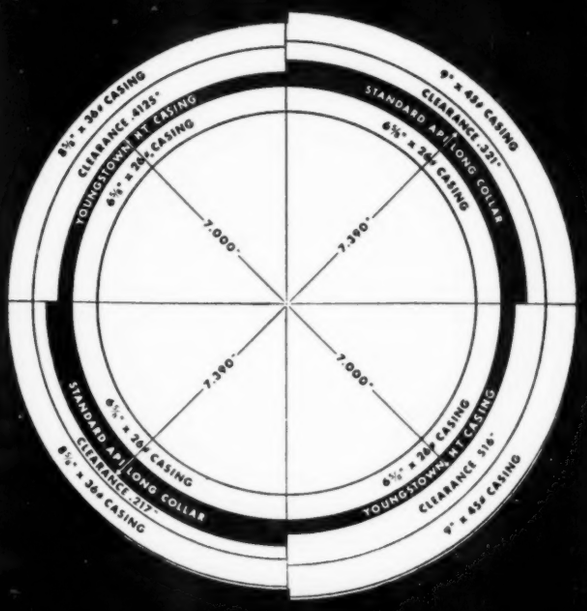
OIL COUNTRY

YOUNGSTOWN

PIPE

YOUNGSTOWN H-T CASING

★ HIGH-TENSILE ★ HIGH-TEST



Because of the smaller diameter of its couplings, YOUNGSTOWN H-T CASING gives greater clearance and thereby reduces underreaming cost. In tensile strength the joints are equal to grade "D" long-couplings. Youngstown H-T Casing is produced with standard A.P.I. threads in all standard sizes, permitting complete interchangeability. The diagram illustrates the greater clearance it provides.

THE YOUNGSTOWN SHEET AND TUBE COMPANY

Manufacturers of Carbon and Alloy Steels

General Offices - YOUNGSTOWN, OHIO

Youngstown's pipe is distributed by --

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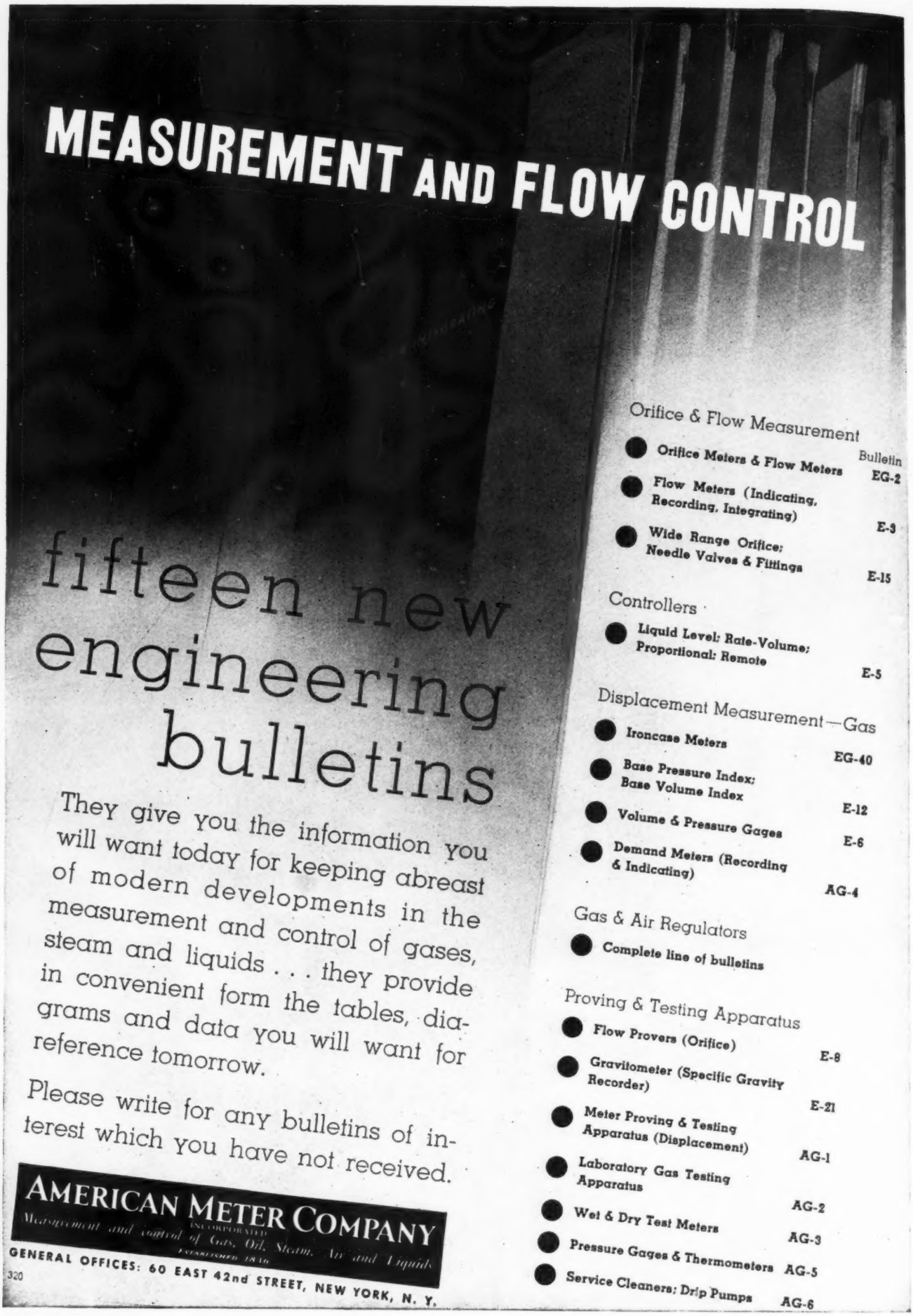
REPUBLIC SUPPLY CO. OF CALIFORNIA, Los Angeles

THE YOUNGSTOWN STEEL PRODUCTS CO. Dashwood House, Old Broad Street, London, E. C. 2, England

523

MEASUREMENT AND FLOW CONTROL



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INCORPORATED
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ESTABLISHED 1836

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320

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SUSTAINED!!

"18. A method of testing the productivity of a formation encountered in a well containing drilling fluid involving the insertion of only a single string of pipe into the well to make a test, which includes lowering a test string into the well through the drilling fluid with a packer carried by the string and a valve inlet at the lower end of the string closed against the entrance of fluid from the well, setting the packer above the formation and opening the valve to permit cognate fluid from the formation to enter the inlet, closing the valve to prevent the subsequent entrance of fluid from the well through the inlet and releasing the packer, and raising the test string with the inlet closed against the entrance of fluid from the well to remove an entrapped sample."

(One of a number of claims in the Halliburton Formation Testing Patent held valid and infringed by the United States District Court for the Eastern District of Texas on September 5th, 1935, in a suit against Johnson Formation Testing Corporation.)

HALLIBURTON
OIL WELL CEMENTING CO.
DUNCAN, OKLA.

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ON A SINGLE OBJECTIVE!

Fig. 1742. GASO Duplex Piston Enclosed Type Power Pump

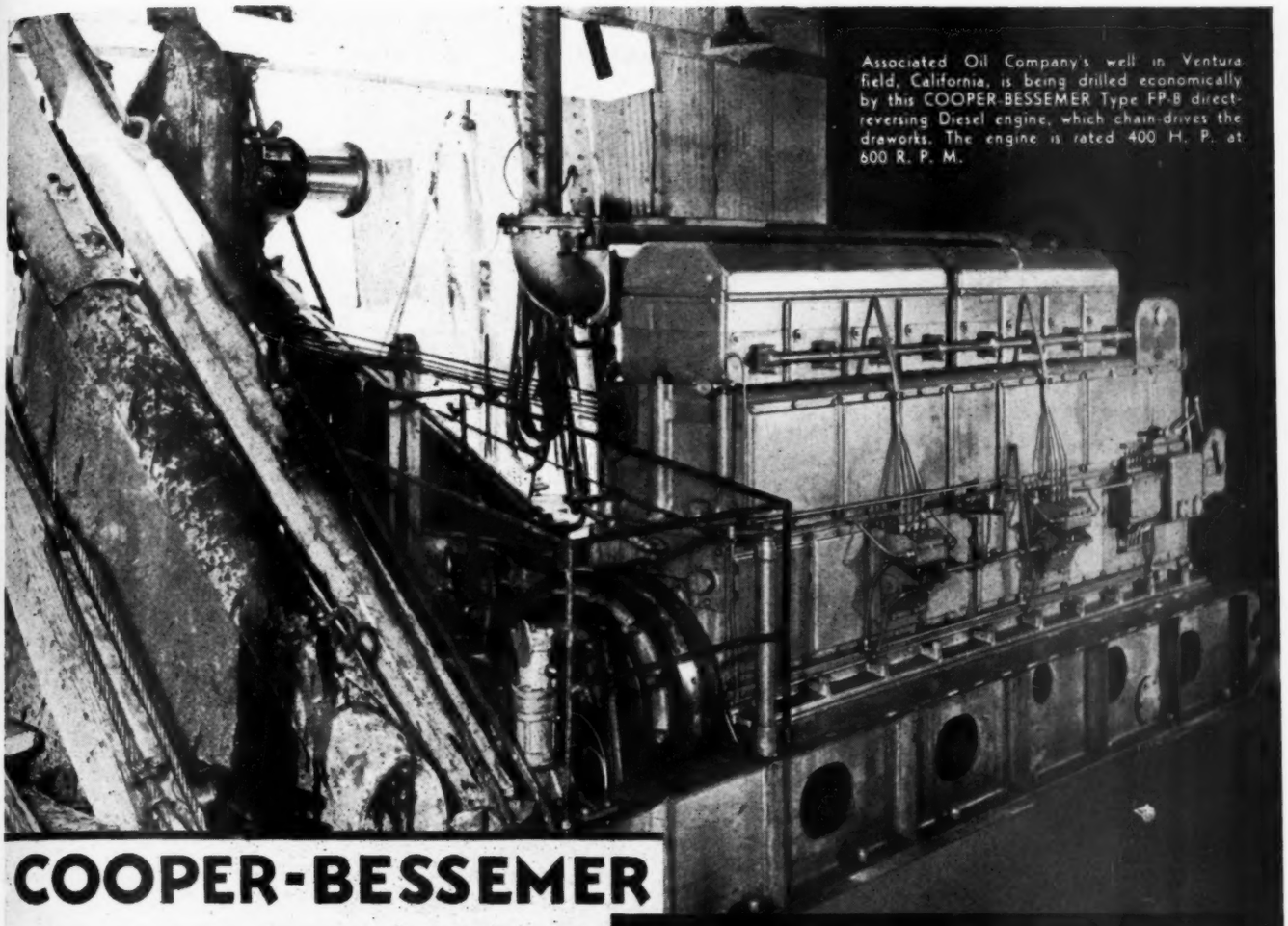
To attain a goal, concentrate upon it. In hunting, never lose sight of the target. In golf, keep your eye on the ball. In business, establish a course and let nothing sway you from it.

For 20 years Gaso has concentrated on the goal of service to the oil industry. Its plant is located in the heart of the oil country. Its executives are veteran oil men. Its pumps are made for oil-industry use. And its service facilities are geared to the exacting requirements of oil-industry conditions.

It is perhaps natural, under these circumstances, that GASO should not only gain but hold a position of LEADERSHIP in its field. . . . May we send you a copy of our latest catalog? GASO PUMP & BURNER MFG. CO., Tulsa, Okla. Export Office: 149 Broadway, New York.

GASO PUMPS

for every oil industry need



Associated Oil Company's well in Ventura field, California, is being drilled economically by this COOPER-BESSEMER Type FP-8 direct-reversing Diesel engine, which chain-drives the draworks. The engine is rated 400 H. P. at 600 R. P. M.

COOPER-BESSEMER PIONEERS IT!

ASSOCIATED OIL PROVES IT!

Direct-Reversing Diesel Drive

Making history in the Ventura field. Twenty-four hours a day . . . two months of extremely hard drilling . . . well over 5,000 feet of hole . . . still proceeding with never a stop!

That's what Associated Oil is doing with this direct-reversing Cooper-Bessemer Diesel — the drive that saves the expense of a reverse clutch . . . the power that performs like steam, yet is a miser on water, fuel and lube oil!

Why not let our nearest representative tell you about this revolutionary accomplishment . . . how this Diesel is controlled remotely from the drilling platform . . . how the constant-pressure fuel injection, and the patented atmospheric-relief system, are making this installation the amazing success it is!

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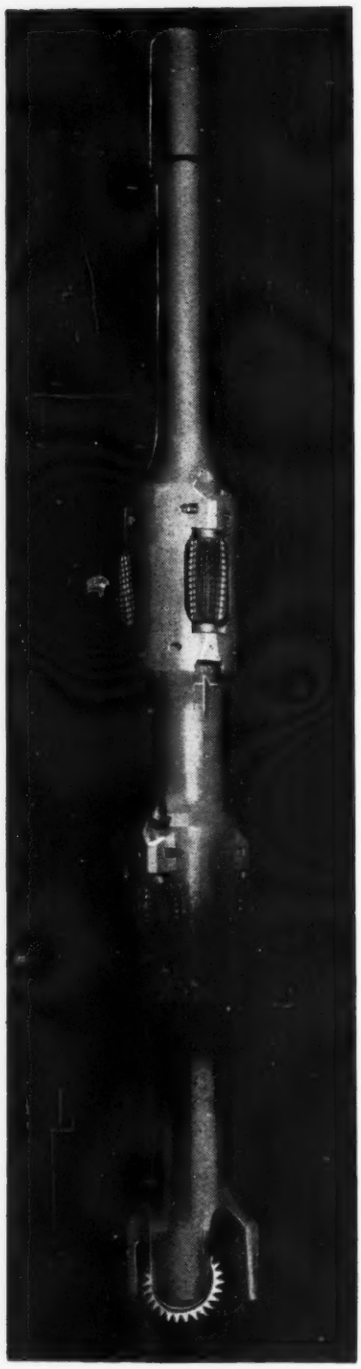
ELIMINATE Crooked Hole COSTS



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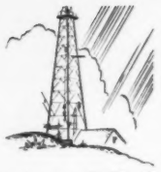
A star performer in every field . . .

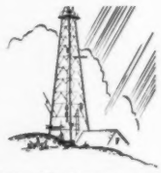
REPUBLIC

ELECTRIC WELD

CASING • TUBING



Port Lavaca Field, Texas
Burton No. 1 Well
5300 ft. of 7-in. O.D., 26-lb.,
Grade C Casing



irfield Field, Freestone Co., Tex.
Ball No. 1 Well
4844 ft. of 7-in. O.D., 22-lb.,
Grade C Casing

Conroe Field, Texas
Keystone Mill No. 1 Well
5050 ft. of 7-in. O.D., 26-lb.,
Grade C Casing

Lea County Field, New Mexico
State Well D 1
3314 ft. of 9⅝-in. O.D., 36-lb.,
Grade C Casing

Potter Co. Field, Penna.
Estes No. 1 Well
5200 ft. of 7-in. O.D., 26-lb.,
Grade C Casing

Oklahoma City Field, Okla.
Owens No. 1 Well
6670 ft. of 7-in. O.D., 26-lb.,
Grade C Casing

Barbers Hill Field, Texas
Bennet No. 1 Well
5000 ft. of 9⅝-in. O.D., 36-lb.,
Grade C Casing

Del Rey Field, Calif.
Colly Del Rey No. 1 Well
6300 ft. of 7-in. O.D., 30-lb.,
Grade C Casing

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ELECTRIC WELD
CASING • TUBING

have proved their performance in these counties

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KANSAS
Barton
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Reno
Rice
Rush
Russell

KENTUCKY
Floyd
Perry
Pike

LOUISIANA
Avoyettes

MICHIGAN
Clare
Gratiot
Isabella
Midland
Montcalm

MONTANA
Glacier

NEW MEXICO
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OHIO
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OKLAHOMA
Carter
Creek
Hughes
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Pontotac
Pottawatomie
Seminole

PENNSYLVANIA
Allegheny
Elk
Potter
Tioga

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Bee
Carson
Chambers
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Live Oak
Montague
Moore
Nueces
Refugio
Rusk
Smith
Upton
Ward
Webb
Wheeler
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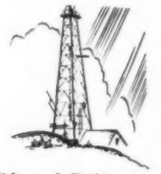
Republic Steel
CORPORATION
GENERAL OFFICES · · · YOUNGSTOWN, OHIO

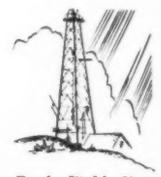
REPUBLIC STEEL

Orlando Field, Okla.
No. 1 Long Well
4965 ft. of 8⅝-in. O.D., 32-lb.,
Grade C Casing

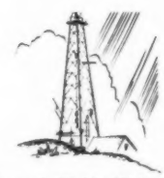
Kettleman North Dome Field, Cal.
Lillis-Welch No. 1 Well
8,300 ft. of 3½-in. O.D., 9.30-lb.,
External Upset Tubing, (Grade C)



Edmond Field, Okla.
Hammond No. 1 Well
5556 ft. of 9⅝-in. O.D., 40-lb.,
Grade C Casing



Cut Bank Field, Montana
Marie Hagerty No. 1 Well
2810 ft. of 7-in. O.D., 22-lb.,
Grade C Casing

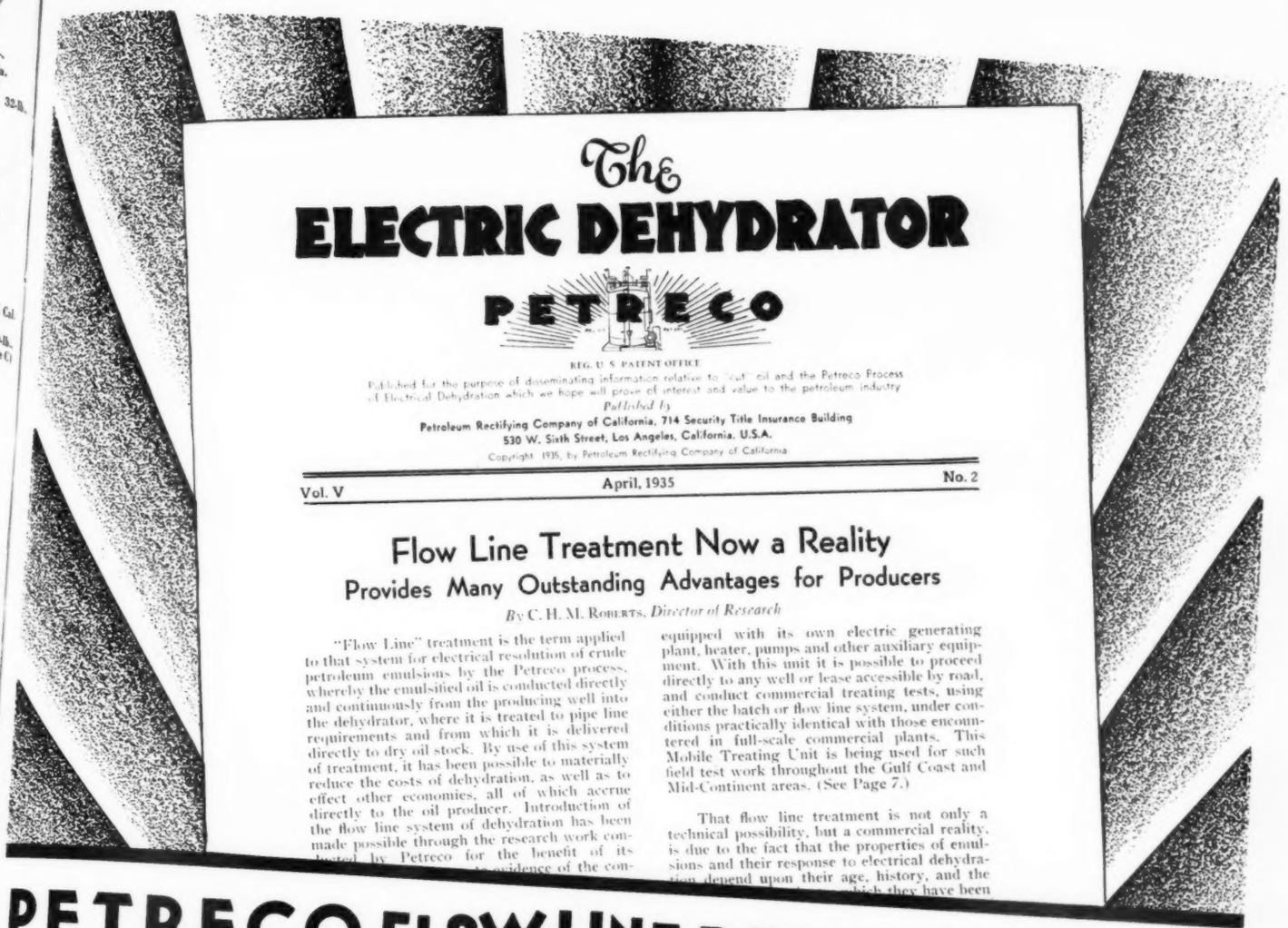


Crystal Field, Michigan
Keel No. 1 Well
3200 ft. of 5½-in. O.D., 14-lb.,
Grade C Casing

Burton Field, Kansas
England No. 3 Well
3594 ft. of 7-in. O.D., 22-lb.,
Grade C Casing

Zoarville Field, Ohio
Upham No. 1 Well
5217 ft. of 5½-in. O.D., 17-lb.,
Grade C Casing

Davis Creek Field, West Virginia
Edgewood No. 1 Well
5200 ft. of 5½-in. O.D., 20-lb.,
Grade C Casing



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PETRECO

REG. U. S. PATENT OFFICE

Published for the purpose of disseminating information relative to "cut" oil and the Petreco Process of Electrical Dehydration which we hope will prove of interest and value to the petroleum industry

Published by

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Vol. V April, 1935 No. 2

Flow Line Treatment Now a Reality

Provides Many Outstanding Advantages for Producers

By C. H. M. ROBERTS, *Director of Research*

"Flow Line" treatment is the term applied to that system for electrical resolution of crude petroleum emulsions by the Petreco process, whereby the emulsified oil is conducted directly and continuously from the producing well into the dehydrator, where it is treated to pipe line requirements and from which it is delivered directly to dry oil stock. By use of this system of treatment, it has been possible to materially reduce the costs of dehydration, as well as to effect other economies, all of which accrue directly to the oil producer. Introduction of the flow line system of dehydration has been made possible through the research work conducted by Petreco for the benefit of its [illegible] evidence of the con-

equipped with its own electric generating plant, heater, pumps and other auxiliary equipment. With this unit it is possible to proceed directly to any well or lease accessible by road, and conduct commercial treating tests, using either the batch or flow line system, under conditions practically identical with those encountered in full-scale commercial plants. This Mobile Treating Unit is being used for such field test work throughout the Gulf Coast and Mid-Continent areas. (See Page 7.)

That flow line treatment is not only a technical possibility, but a commercial reality, is due to the fact that the properties of emulsions and their response to electrical dehydration depend upon their age, history, and the [illegible] which they have been

tricts [illegible] (Texas) district there is a complete [illegible] motorized, semi-plant scale field test unit. This unit is complete and self-contained, being

ing [illegible] priately be stated in terms of the [illegible]

(Continued on page 3)

(1) *Electric Dehydrator, March, 1934.*
(2) *Electric Dehydrator, Jan., 1935.*

PETRECO FLOW-LINE DEHYDRATION Offers *Unusual Advantages* to Producers

SEND FOR YOUR COPY

April and July issues of "The Electric Dehydrator" contain the complete story of Petreco Flow-Line Dehydration—the process, results obtainable, and its advantages. Every individual interested in the dehydration of emulsified crudes should have this information. Copies will be supplied to oil company executives on request.

Petreco flow-line treatment provides all the advantages of electrical dehydration *plus* certain additional advantages not available by other methods. It assures the lowest "cut", highest gravity and maximum market price possible by any process. Every producer of emulsified crude will be vitally interested in the complete story of this recent development as set forth in recent issues of our bulletin "The Electric Dehydrator". Copies of these issues, with furthur detailed information, will be supplied on request.

PETROLEUM RECTIFYING COMPANY OF CALIFORNIA

General Offices: 530 West Sixth Street, Los Angeles, California.

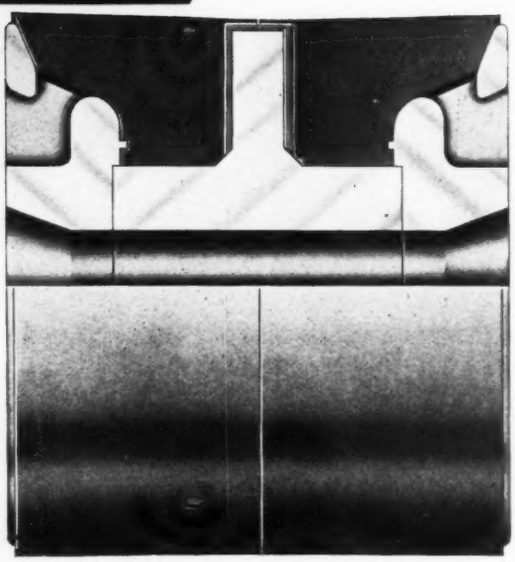
Branch Office: Houston, Texas. Branches and Service Men in Principal Oil Fields.

LOWEST "CUT"-HIGHEST GRAVITY-MAXIMUM PRICE

Now!

MacCLATCHIE *wearever* PUMP PISTON

with LONGITUDINAL BACKING ON THE SUCTION STROKE



Showing the end plates forming abutments for the sealing lips on the suction stroke.

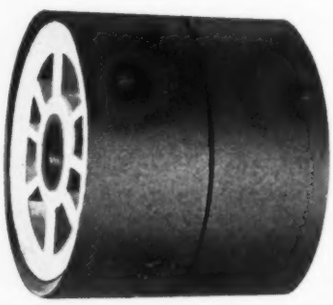
ON the pressure stroke the brass plates which are molded to the cup-rubbers engage the central flange—and on the suction stroke the end plates engage the rims of the cups. The cup-rubbers are thus longitudinally backed-up on both the pressure and the suction stroke—insuring a tight seal on the pressure stroke, and permitting the cup-rubbers to yield only slightly on the suction stroke so as to reduce friction, but holding the cup-rubbers against such yielding as would permit sand and grit to lodge and cut out the rubbers.

LOW MAINTENANCE

Each cup-rubber and its brass plate forms a unitary replaceable rubber, so that the piston may be renewed simply by installing new rubbers—the cost of which is less than half the cost of the original piston.

SAVING IN LINERS

Nothing but rubber and the soft brass reinforcement plates contact the liner surface, thereby materially prolonging the life of the liner.



External View

SOLD BY ALL LEADING SUPPLY HOUSES

THESE FEATURES INSURE LONGER WEAR AS DEMONSTRATED BY ACTUAL COMPARATIVE TESTS

TEST NO. 1—Running against a competitive piston in the other cylinder of the same pump, the competitive piston was replaced four times, with a new liner required at each replacement, while a MacClatchie Piston ran with the original rubbers and without liner replacement.

TEST NO. 2—Running against the same competitive make of piston, a MacClatchie piston ran 16 hours longer than the competitive make in the other cylinder of the same pump.

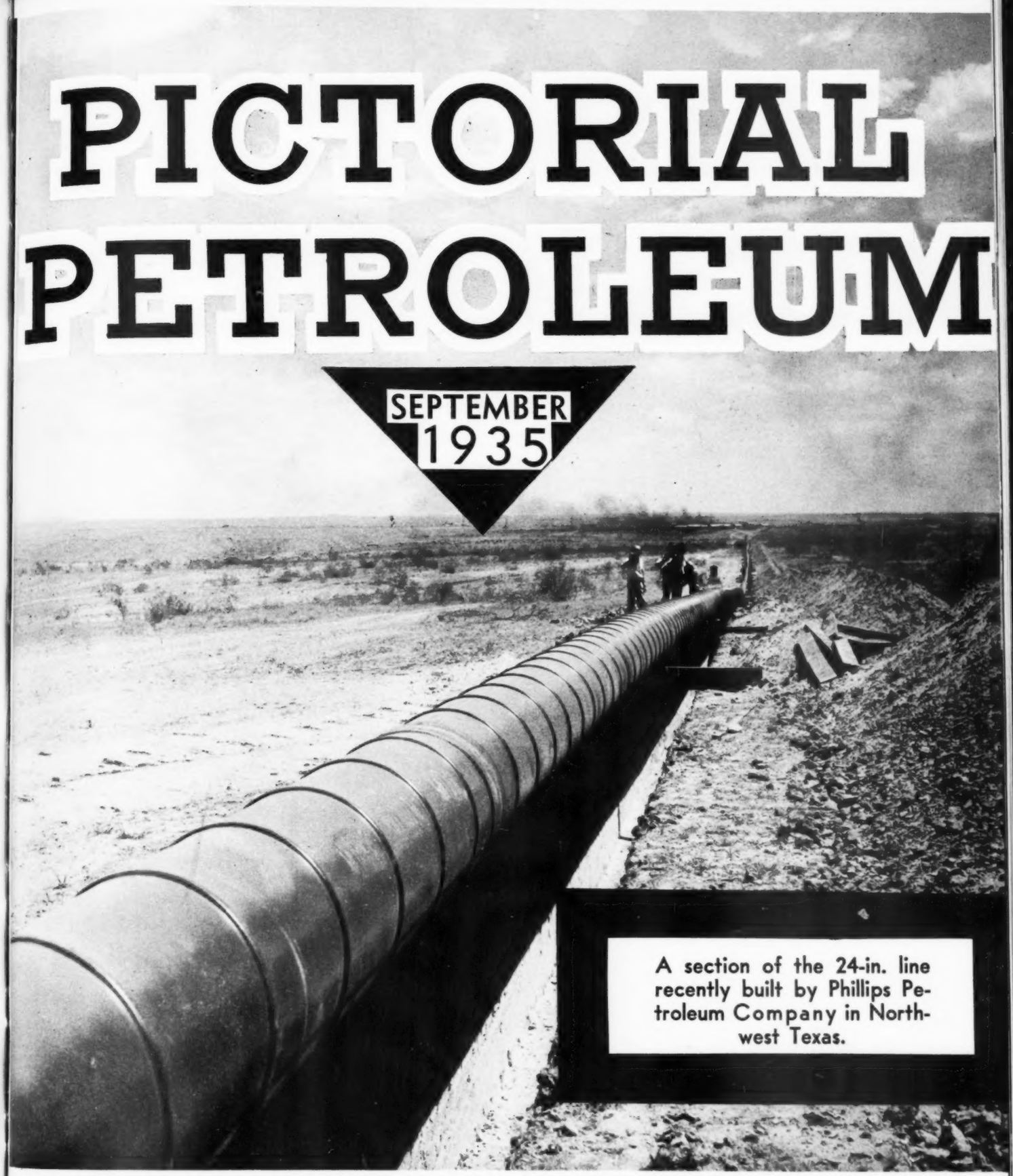
TEST NO. 3—Running against another competitive make, a MacClatchie Piston outwore three of the competitive make in the other cylinder of the same pump, and the MacClatchie Piston was still in good condition when then removed due to the piston rod wearing out.

MacCLATCHIE MANUFACTURING CO.

COMPTON, CALIFORNIA HOUSTON, TEXAS

PICTORIAL PETROLEUM

SEPTEMBER 1935

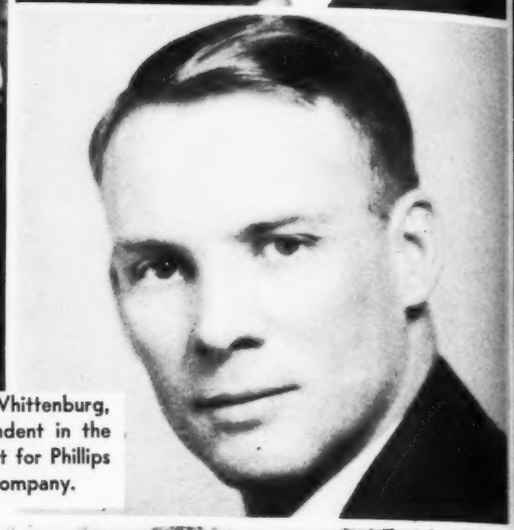


A section of the 24-in. line recently built by Phillips Petroleum Company in Northwest Texas.

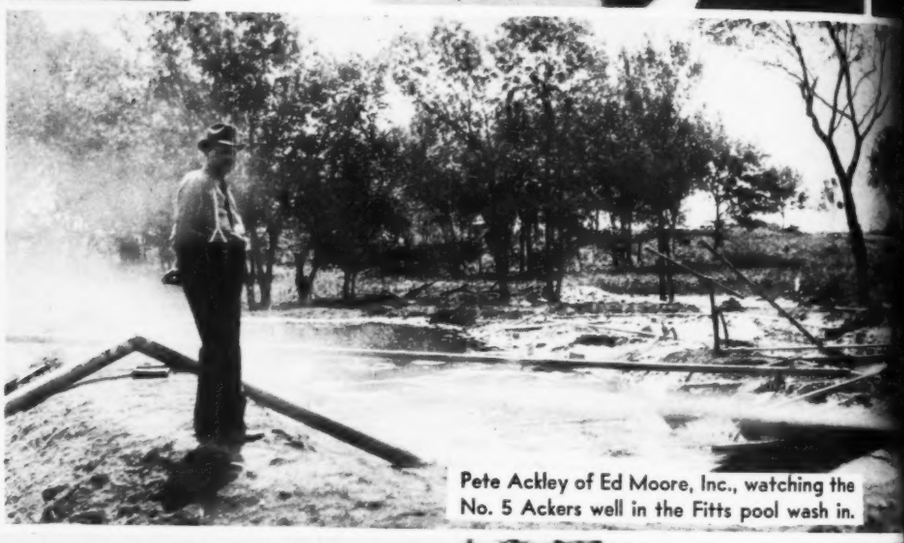
A REGULAR FEATURE OF THE PETROLEUM ENGINEER

This group was recently photographed on Associated Oil Company's Lloyd No. 136 well in California. Left to right: L. R. Smith, chief resident engineer, Associated Oil Company; A. E. Warren, general drilling superintendent of the same company; Martin Mears, production superintendent of the Ventura Division for Associated; and Ben Dumm of Cooper-Bessemer Corporation.

H. M. Stalcup, vice-president in charge of production, Skelly Oil Company, Tulsa, Oklahoma.



C. A. Daniels, Whittenburg, Texas, superintendent in the Panhandle district for Phillips Petroleum Company.



Pete Ackley of Ed Moore, Inc., watching the No. 5 Ackers well in the Fitts pool wash in.

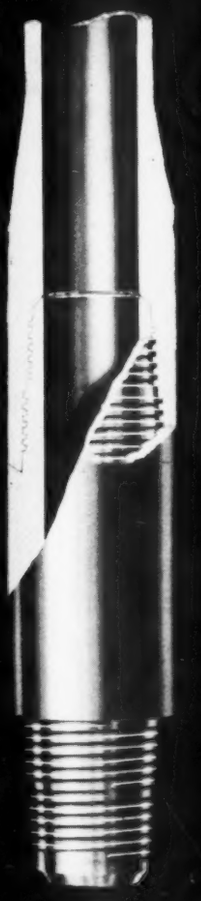
Three of Stanolind Oil & Gas Company's Texas operating men. Left to right: E. J. Harmon, district superintendent, Longview; J. H. Moyar, division superintendent, Fort Worth; and Ira Page, assistant district superintendent, Longview.

A view of one of the oil industry's better kept leases — Minnehoma Pugh lease in the Oklahoma City field.

HYDRIL

DRILL PIPE and CASING for EVERY PURPOSE

STRONGER AND BETTER IN PERFORMANCE . . . USED THROUGHOUT THE WORLD BY MAJOR OPERATING COMPANIES

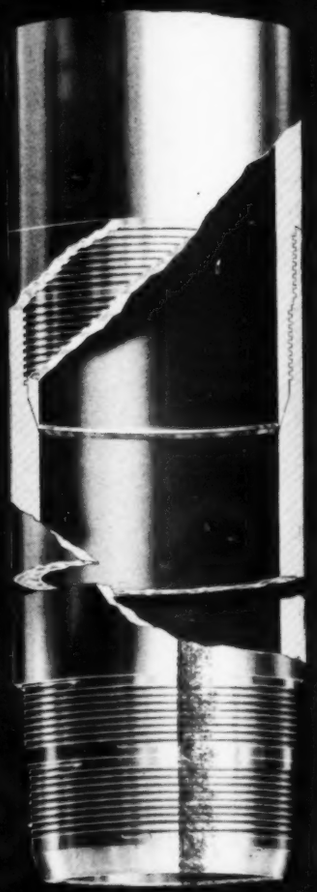


INTERNAL FLUSH JOINT DRILL PIPE

The fluid passage through the tool joints is the same as the full inside diameter of the drill pipe. Gives the MAXIMUM circulation area possible. (Patented)

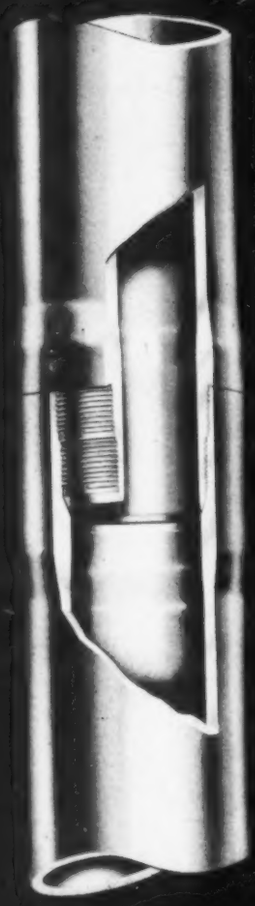
EXTERNAL FLUSH JOINT DRILL PIPE

Essential for Pressure and Controlled Drilling. Passes through packers with maximum ease; offers advantages when used for ordinary drilling. (Patented)



INTERNAL AND EXTERNAL FLUSH JOINT CASING

Quickly and safely run through packers under pressure. Saves time and money in regular casing programs. (Patented)



EXTERNAL UPSET CASING

All the features that have made the Hydril casing joint a leader in efficiency are present PLUS greatly increased joint strength. The diameter of the upset is much smaller than a coupling. (Patented)

TRADE MARK REG.

HYDRIL

HYDRIL COMPANY

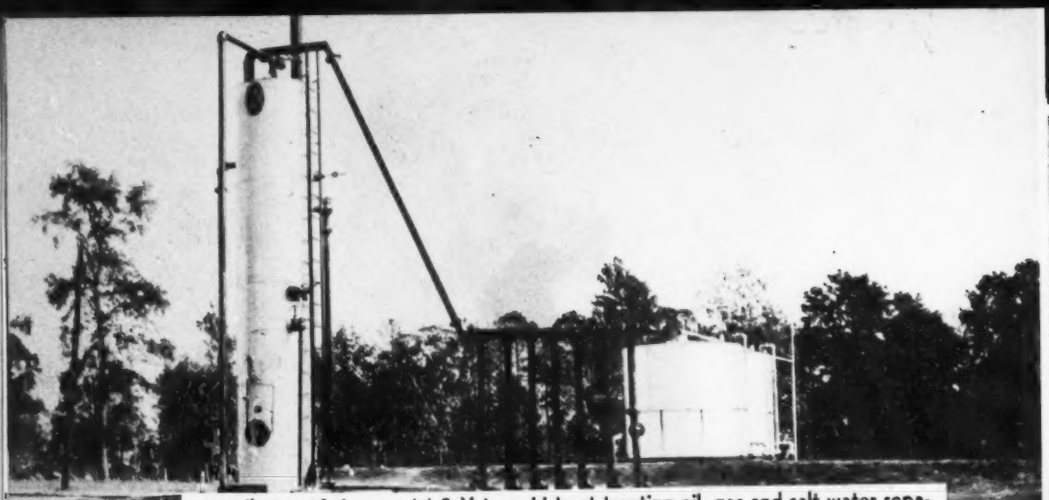
714 West Tenth Street • Los Angeles, Calif.

DOHENY STONE DRILL CO.

OF TEXAS

4300 Calhoun Road • Houston, Texas

Cable Address—HYDRIL

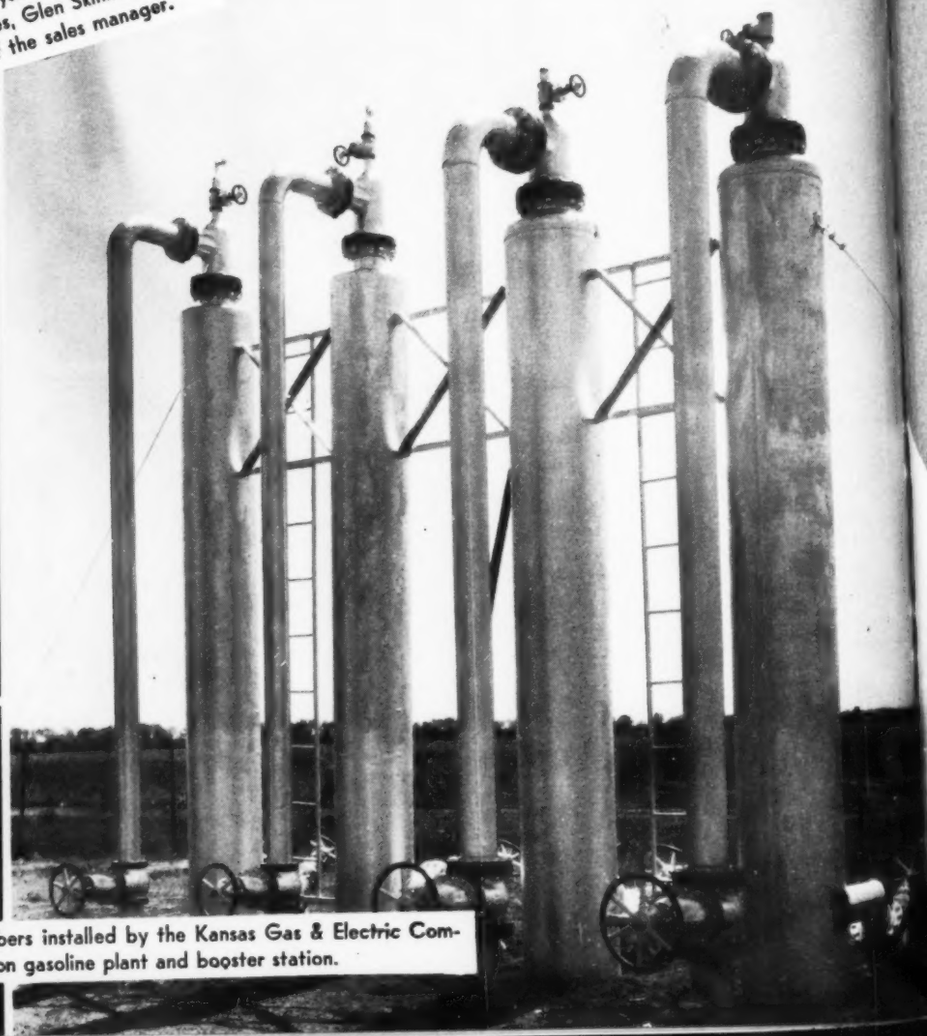


Installation of the new M & V type H heat treating oil, gas and salt water separator for use in treating emulsified crude oils. This equipment is manufactured by M & V Tank Company, Wichita Falls, Texas.

Taken at Jennings, Louisiana—the first wildcat well in that field—in the spring following discovery of oil at Spindletop. This was one of the first combination standard tool-rotary rigs ever built. Rig built by W. R. Martin of Martin-Decker Corporation, who appears in the photograph with the skin of an alligator caught within 100 ft. of the boiler.

Photograph taken at a picnic given by Black, Sivalls & Bryson Company, Oklahoma City, for their employees. Left to right: Mr. Feagles, Glen Skinner, secretary and treasurer; and Mrs. A. J. Edwards, wife of the sales manager.

M. R. (Red) Gayle, Mid-Continent district representative for Broderick & Bascom Rope Company, St. Louis, Missouri.



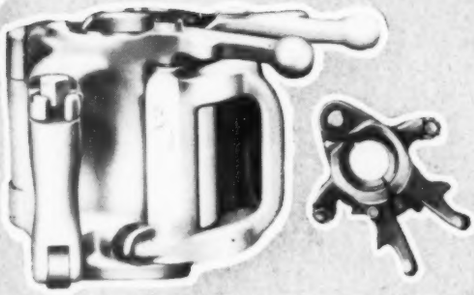
New high-pressure gas scrubbers installed by the Kansas Gas & Electric Company at McPherson gasoline plant and booster station.

FOR Every SERVICE

THE SIDE DOOR (DUNN TYPE) HANDLES DRILL PIPE TUBING & CASING.

THE SIDE-DOOR (WILSON TYPE) ELEVATOR IS A STANDARD THROUGHOUT THE WORLD.

CENTER LATCH (DUNN TYPE) ELEVATORS ARE MADE IN MANY SIZES FOR TUBING, DRILL PIPE, CASING.



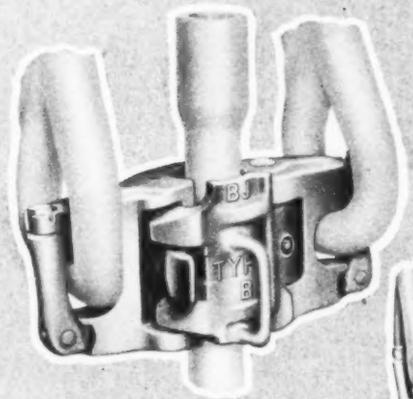
TYPE G ELEVATORS HANDLE EXTERNAL UPSET DRILL PIPE WITHOUT USING LIFTING PLUG.

THE FRICTION GRIP IS THE ONLY SUCCESSFUL ELEVATOR FOR HANDLING SURFACE CASING.

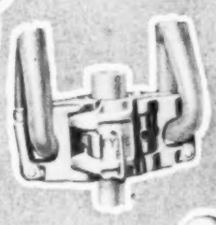
BJ ROD ELEVATORS HAVE BOTH FRONT AND REAR OPERATING LATCHES.

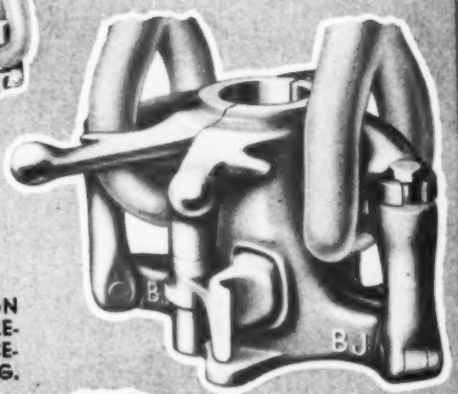
THE ONE-PIECE BODY IS HEAT TREATED.

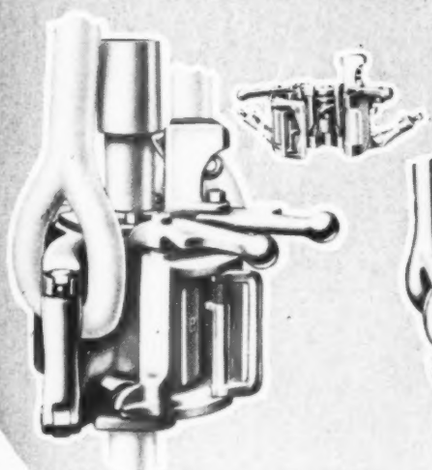
CENTER LATCH (WILSON TYPE) ELEVATORS NEED NO INTRODUCTION TO THE OIL INDUSTRY.

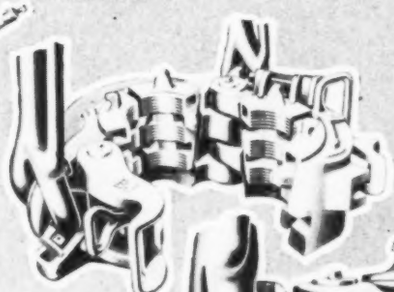


THE TYPE B SIDE DOOR ELEVATOR HAS MODERN SAFETY ADVANTAGES IN HANDLING EXTERNAL UPSET DRILL PIPE.





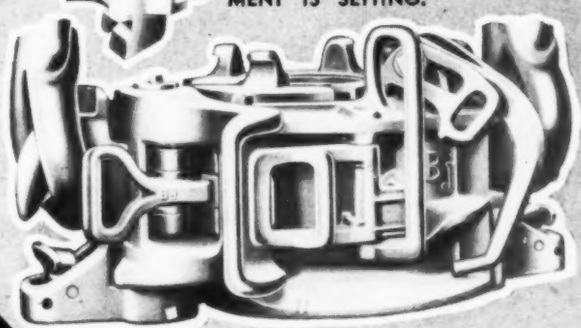




SIDE-DOOR DESIGN PERMITS EASY REMOVAL WHILE CEMENT IS SETTING.

TYPE A ELEVATORS AFFORD SAFETY AND CONVENIENCE IN HANDLING THE LONGEST STRINGS OF DRILL PIPE.

THE TYPE C CARRIES TUBING OR DRILL PIPE ON SLIPS INSTEAD OF LIFTING UNDER THE COUPLING.



BJ SIDE DOOR SLIP ELEVATORS ARE SAFE FOR STRINGS OF CASING OR DRILL PIPE OF ANY LENGTH.

BYRON JACKSON CO.
AND SUBSIDIARY
FORT WORTH • LOS ANGELES • NEW YORK

ELEVATORS

This 210-hp. Waco 4-place cabin plane was recently bought by Eastman Oil Well Survey Company of Texas to facilitate field service throughout Texas and Louisiana. It cruises at 115 miles per hour, has a top speed of 140 miles per hour and a cruising radius of 550 miles. The men, left to right, are: James D. Hughes, president of the company; Jim Davis, one of the Southwest's leading flyers; and Guy Brown, secretary-treasurer of the Eastman Company of Texas.

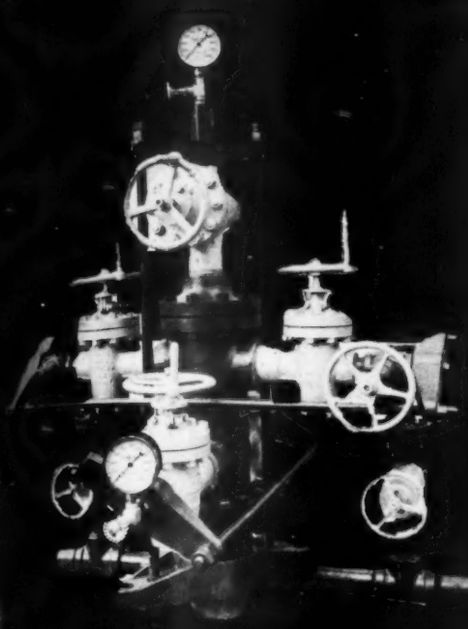
Charles R. Krause, president, Lee C. Moore & Co., Inc. Mr. Krause maintains headquarters in Tulsa, Oklahoma.

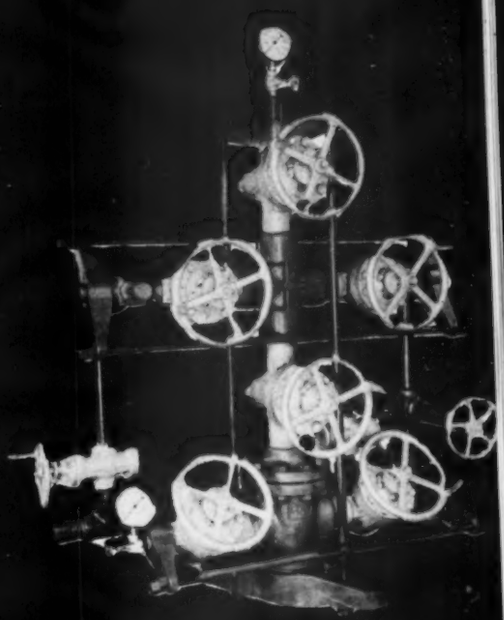
E. Jeffers, independent producer, Burkburnett, Texas.

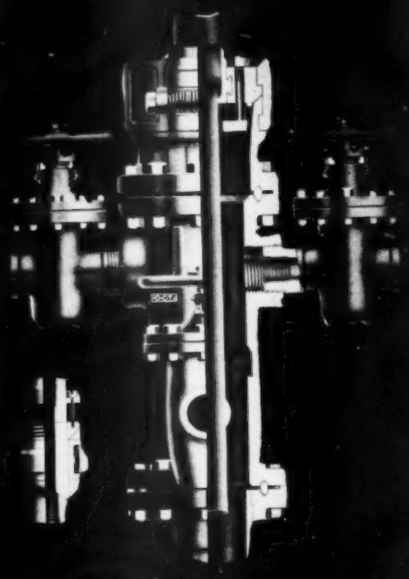
Field office of Lufkin Foundry & Machine Company, Henderson, Texas.

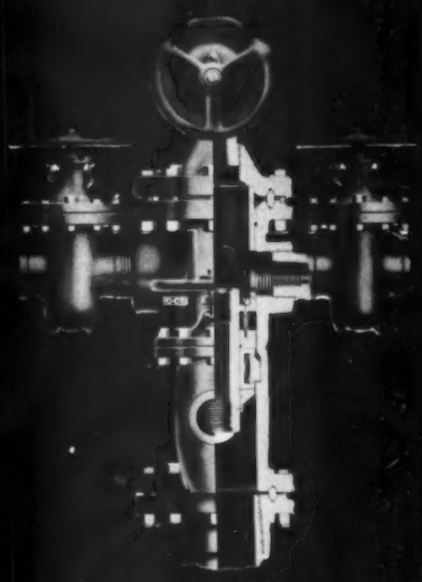
otograph taken at a fishing party given by Texas Electric eel Casting Company, Houston, Texas. Fishing 53 miles t of Galveston, on the Gulf of Mexico, the party's catch taled 732 pounds of fish. Standing, left to right: Terry alehite, owner and captain of the "Norma Webb"; harlie Reynolds, Oil Equipment Sales Corporation; Jack Valmsley, Chief Gaff-hook Artist; Frank Brewis, Port Houston Iron Works; P. O. Davis, Pure Oil Company: Otto G. Keil, Gulf Engineers. Seated, left to right: Lee Hewitt, American Iron & Machine Works; F. M. Wittlinger, Texas Electric Steel Casting Company; R. R. Grove, Cameron Iron Works; Perry Hamilton, Oil Equipment Sales Corporation; Jack Myracle (son of Mike Myracle), American Iron & Machine Works; A. Henderson, J. H. McEvoy & Co.; C. W. Shartle, Texas Electric Steel Casting Company; and E. Barker, Atlas Engineering Works.

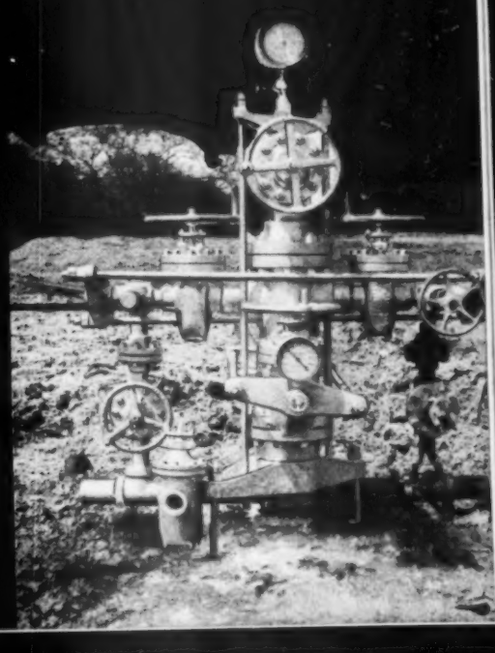
Walter Steiner, president, Walter Steiner Production & Refining Company, Long Beach, California.



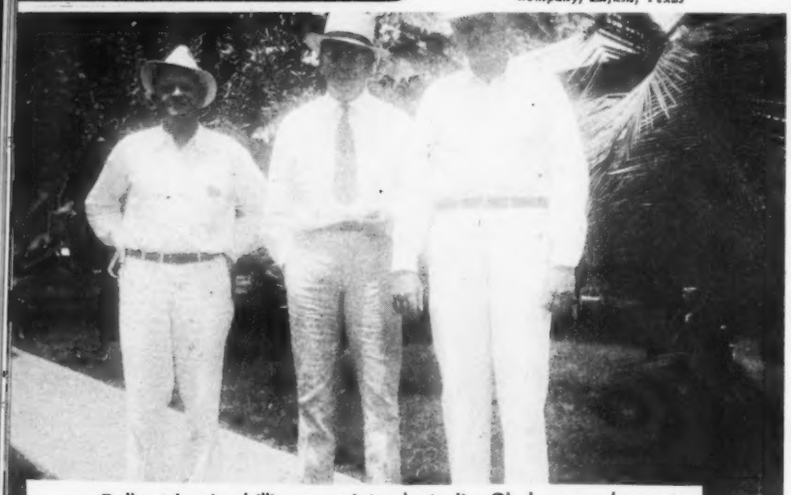




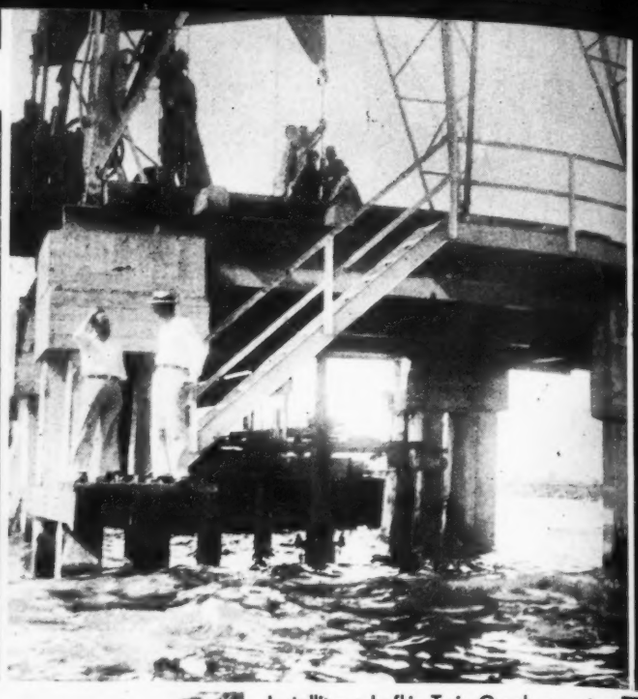




All photographs on this page reproduced through the courtesy of Lufkin Foundry & Machine Company, Lufkin, Texas

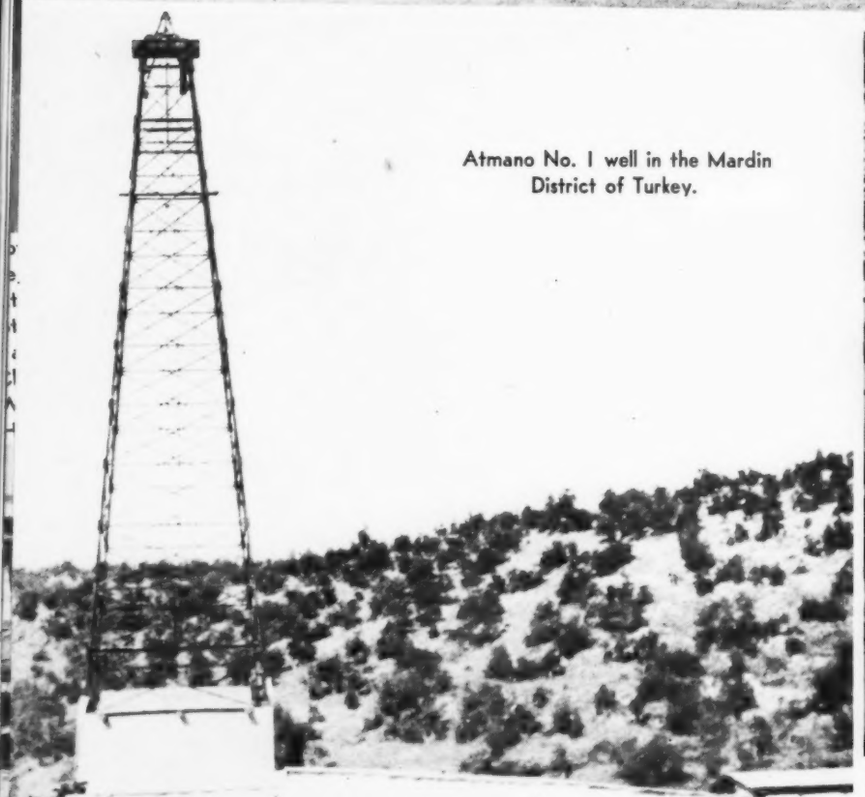


Delbert Lewis, drilling superintendent; Jim Clark, general superintendent; and Arthur Proudfit, division superintendent, all with the Lago Petroleum Corporation at Lake Maracaibo.

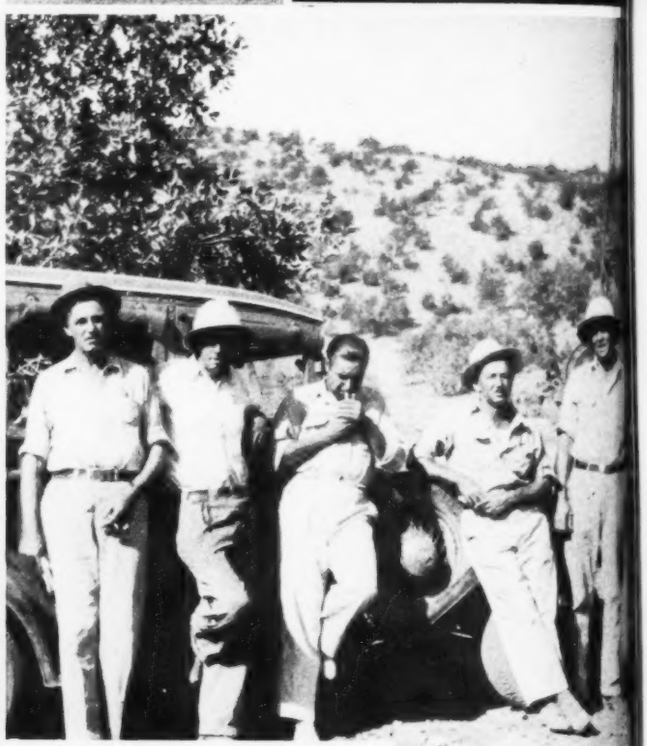


Installing a Lufkin Twin Crank pumping unit, Lake Maracaibo, Venezuela.

General offices of the Standard Oil Company of Venezuela, Caripito, Venezuela.

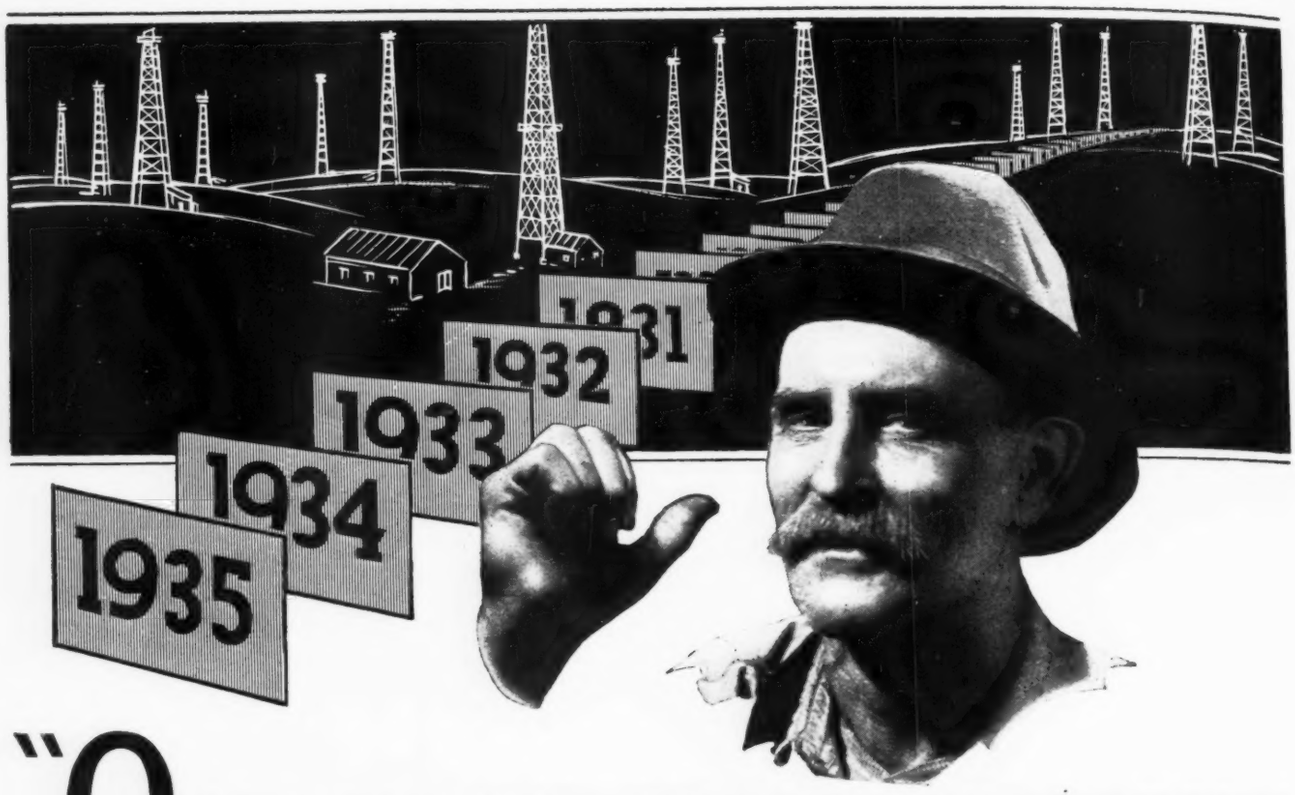


Atmano No. 1 well in the Mardin District of Turkey.



Messrs. Woodson, Shirley, Ishan Ruhi, S.H. Russell and Yocom. At the time this picture was taken these men were all employed in drilling wells for the Turkish Government.

BAROID ★ AQUAGEL
A Complete Drilling-Mud Service
★ STABILITE ★
N1621
Stocks Carried and Service Men Available in All Active Oil Fields.
BAROID SALES COMPANY
LOS ANGELES HOUSTON
NATIONAL PIGMENTS & CHEMICAL COMPANY, ST. LOUIS



"OLD MAN EXPERIENCE TAUGHT ME WIRE LINE ECONOMY"

"OLD timer, they call me, because I've worked a good many years—and was present at the bringing in of a lot of wells. I've heard plenty of talk about Wire Lines. I've done a lot of experimenting—but Old Man Experience taught me one big fact that I'm passing along to you. Regardless of where you're located—or what your needs may be—you'll find Tiger Brand Wire Lines, made by the American Steel & Wire Company—to be the longest wearing, most dependable and economical answer that you can find. And—in addition—you'll get the kind of service—which, you'll agree is mighty important."

AMERICAN STEEL & WIRE COMPANY

TIGER BRAND WIRE LINES

REG. U. S. PAT. OFF.

AMERICAN STEEL & WIRE COMPANY

208 S. LA SALLE STREET, CHICAGO • • EMPIRE STATE BUILDING, NEW YORK

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Offices in All Principal Cities

Export Distributors: United States Steel Products Company, New York

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ANOTHER NEW UNIT

S.C.-54 Series

by PARKERSBURG

Specifications:

CONSTRUCTION
Welded for strength and rigidity.

CAPACITY
25,000 lbs. peak load.

RANGE OF STROKES
27″, 36″, 45″ and 54″.

OPERATING SPEEDS
10 to 28 S.P.M. normal or up to 36 S.P.M. for taking potentials.

COUNTERBALANCE
Combination crank and beam weights—13,770 lbs. maximum at 54″ stroke.

BEARINGS
Fully enclosed flood lubricated, dust and oil tight. Self-aligning roller bearings on wrist pins.

PITMAN
Fully equalized five bearing assembly.

DRIVE
Any type prime mover.

GEAR REDUCTION UNIT
Double helical, herringbone type. Designed especially for heavy oil field service.

INCORPORATING many features found in no other pumping unit of similar type, the S. C. - 54 series offers the utmost in efficiency and dependability.

Structural parts are welded throughout for strength and rigidity. Shafts, pinions and gears are heat-treated. The unit proper consists of but five easily portable sub-assemblies. With a range of operating speeds up to 36 S.P.M., they are ideal for taking potentials. Bearings are built for years of continuous, trouble-free service.

In design and construction the S. C. - 54 series incorporates the finest principles of pumping unit manufacture.

The S. C. - 54 series is made in two capacities — the S. C. - 54 A with a horsepower capacity of 27 at 20 S. P. M., and the S. C. - 54 B with a horsepower capacity of 48.7 at 20 S. P. M.

Booklet KR-7-35 sent on request

Parkersburg Pumping Well Data and Production Tables.. over 70,000 calculations for wells from 500′ to 8000′ deep. The most comprehensive work of its kind ever compiled. Copies are now available.

THE PARKERSBURG RIG AND REEL CO.

PARKERSBURG, WEST VIRGINIA

Branches in All Active Fields

NEW YORK
TULSA
HOUSTON
DALLAS

O. R. Lane New Sales Representative for Kennedy Valve

The Kennedy Valve Manufacturing Company, Elmira, New York, announces the appointment of O. R. Lane as its representative in Oklahoma, Arkansas, Tennessee, Eastern Missouri, and Southern Illinois and Indiana, with headquarters at 455 Paul Brown Building, St. Louis, Missouri.

Lane, who has had extensive experience in this field, will handle the sales of Kennedy iron body and bronze gate, globe, angle, and check valves, malleable-iron and bronze screwed pipe fittings, cast-iron fittings and flanges, and fire hydrants for industrial plants, oil refineries, buildings, and municipalities.

Victaulic, Inc., to Serve California

Announcement is made of the formation of Victaulic, Inc., who will handle products of Victaulic Company of America and Hanlon-Waters, Inc., in California. Offices of the company are in the Roosevelt Building, 727 West Seventh Street, Los Angeles. Gene McIntyre, who is well known to the California pipe trade, is in charge of sales.

Victaulic couplings have played an important rôle in recent years in the pipe program of California petroleum companies, mining companies, and municipal sewage and water departments. Each coupling combines the features of a straight line coupling, a flexible coupling, an expansion joint, and a mechanically locked joint. A minimum of time and labor is involved in assembling the joint and it is permanently leaktight, the manufacturers state.

Victaulic, Inc., also will handle the Hanlon-Waters line of oilfield equipment manufactured in Tulsa, Oklahoma, and including oil and gas separators, automatic regulating and control equipment, load binders, and gauge cocks.

A. M. Byers Company Broadens Activities

The A. M. Byers Company, Pittsburgh, Pennsylvania, has announced to the trade the third major expansion project for this company in recent years. Several years ago Byers completed a large, modern wrought iron mill at Ambridge, Pennsylvania, for manufacturing genuine wrought iron under their new process. Following this, the operations were further expanded to include the reintroduction of a wide range of wrought-iron products that includes plates, sheets, merchant bars, angles, structurals, and forging billets.

The third step in broadening the sales and manufacturing activities of the company was taken when J. Frederic Byers, chairman of the board, announced recently that Byers steel pipe would be manufactured in addition to the present complete line of wrought-iron products.

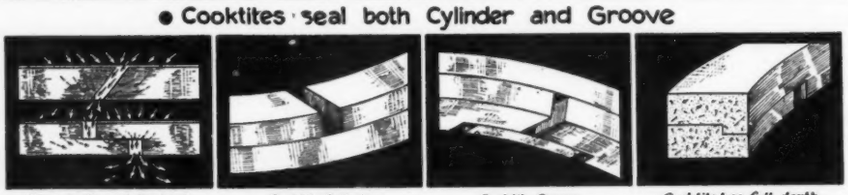
Mid-Continent Supply Co. Opens Rodessa, Louisiana, Store

The Mid-Continent Supply Company, general offices Fort Worth, Texas, recently opened a new store at Rodessa, Louisiana, with G. C. Colwell in direct charge as store manager. This territory is under the supervision of S. W. Backus, district manager, at Shreveport, Louisiana, where the company maintains district offices. Backus, with the Oil Well Supply Company for many years, recently entered the employ of the Mid-Continent Supply Company.

COOK'S RINGS
will do a better job
. . . and they'll prove it!

COMPARATIVE OPERATING DATA on internal combustion engine performance before-and-after installing COOK'S GRAPHITIC IRON RINGS, have been supplied to us by a host of enthusiastic users. These records **prove** that COOK'S RINGS are directly responsible for **increased efficiency and reduced maintenance cost** in thousands of internal combustion engines. They will do as much for your engines. A trial will prove it. Order them on your next replacement job.

● Cooktites seal both Cylinder and Groove



Blow-by through the joints in ordinary rings | *Cooktite Cylinder Seal* | *Cooktite Groove Seal* | *Cooktite has full depth radial strength*

C. LEE COOK MANUFACTURING CO.

New York Cleveland | Los Angeles Baltimore | INCORPORATED LOUISVILLE, KY. | Chicago Tulsa | New Orleans San Francisco

R. L. "Bob" Bothwell Joins Staff American Iron & Machine Works Co.

R. L. "BOB" BOTHWELL

R. L. "Bob" Bothwell, of Los Angeles, California, has joined the staff of the American Iron and Machine Works Company, Oklahoma City, as their California representative. Bothwell's headquarters will be with the Oil Well Supply Company of Los Angeles, and his territory will include all California.

Bothwell has lived in Los Angeles for the past 11 years, six of which he was with the Richfield Oil Company as assistant manager of the land department. Prior to going to California he was connected with a drilling contractor, acting as drilling superintendent in the Wichita Falls, Texas, and Casper, Wyoming, territories.

Bothwell comes from a family that is widely known in petroleum circles. Don C. Bothwell, a brother, is manager of the Darby Petroleum Corporation, Tulsa, Oklahoma, while E. C. Bothwell, another brother, is vice-president and assistant to the president of the Gulf in Pittsburgh, Pennsylvania.

Plans Being Made for 1936 International Petroleum Exposition

Plans for the ninth International Petroleum Exposition and Congress, to be held in Tulsa May 16 to 23, 1936, are under way and indications are that the show will have the largest display of heavy equipment in its history, according to General Manager W. B. Way.

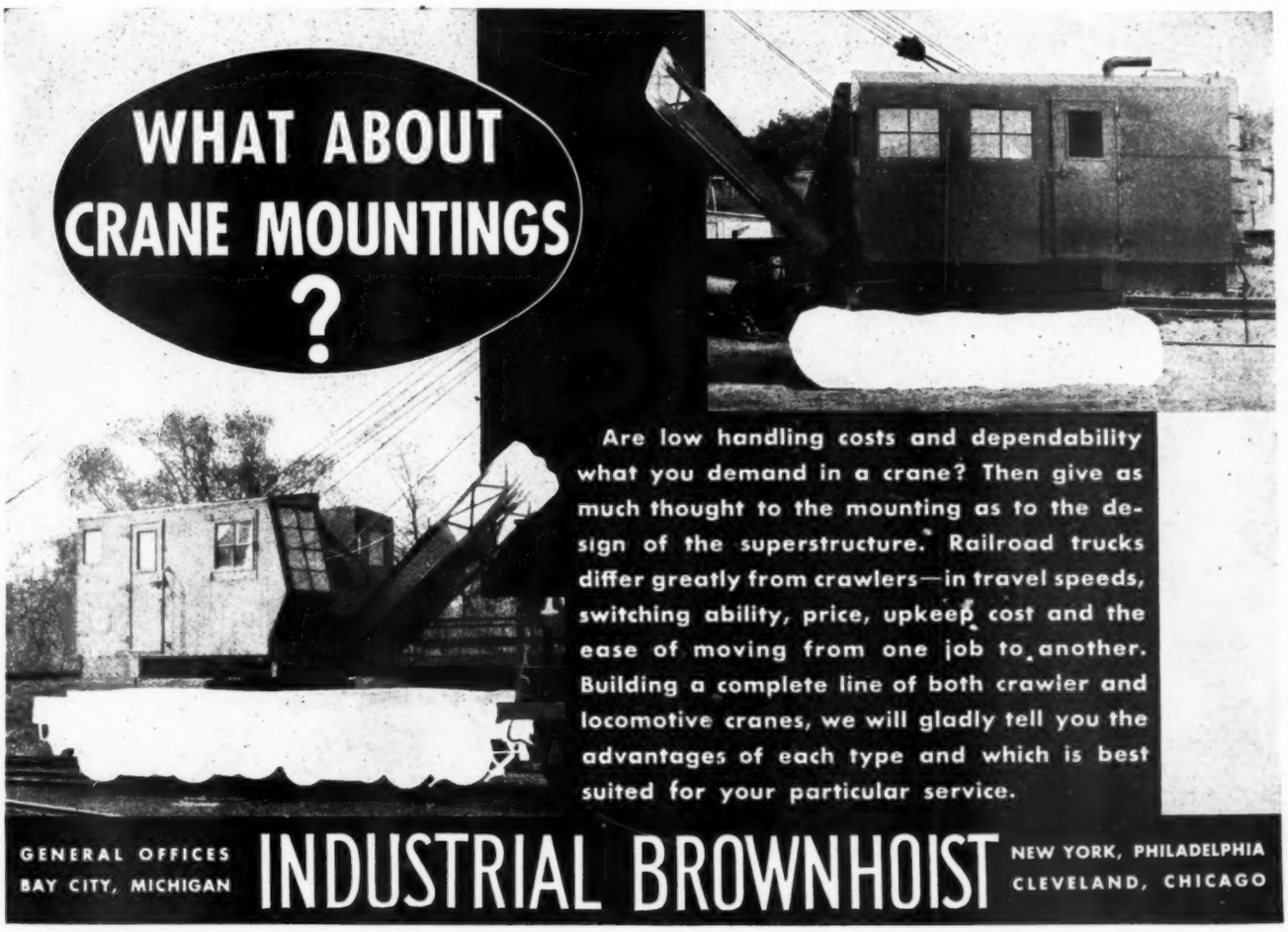
"Approximately 100 booths already have been sold and more than 50 percent of the 1934 exhibitors have replied to a questionnaire sent out by the board of directors that they will exhibit in 1936. Of the 50 percent nearly half have indicated that they desire increased space."

The International Petroleum Exposition is a non-profit institution owned and controlled by the industry, and its board of directors consists of leaders of both major and independent companies in the producing, pipe line, refining, and marketing divisions.

A half million dollar plant on a 20-acre site houses the estimated ten million dollar exhibits by approximately 1,500 different firms at each exposition. The plant consists of five major general exhibit buildings and many smaller ones owned by individual firms who exhibit at each show.

At the 1934 show delegates and representatives attended from 16 foreign countries as well as the majority of the states of the union.

According to W. G. Skelly, president of the Skelly Oil Company and president of the exposition, the dates were set in accordance with the wishes of the exhibitors, a majority of whom replied to a questionnaire that they felt a show every two years is best for the industry.


WHAT ABOUT CRANE MOUNTINGS ?
Are low handling costs and dependability what you demand in a crane? Then give as much thought to the mounting as to the design of the superstructure. Railroad trucks differ greatly from crawlers—in travel speeds, switching ability, price, upkeep cost and the ease of moving from one job to another. Building a complete line of both crawler and locomotive cranes, we will gladly tell you the advantages of each type and which is best suited for your particular service.
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PUMPS AND SUCKER RODS

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Mid-Continent and Eastern Distributor: Frick-Reid Supply Corp.
Rocky Mountain Distributor: Great Northern Tool & Supply Co

Prominent Figure Passes in Death of Edward L. Doheny

Edward Laurence Doheny, internationally prominent oil man and one of the most colorful in the industry, passed away at his home in Beverly Hills, California, September 8, following an illness of long duration. He was 79 years of age.

Doheny, born in Fon du Lac, Wisconsin, left home at the age of 16 to make his fortune. Gold was his goal, and it was not until 20 years later that he first became interested in oil. Believing there to be oil on a certain location in Los Angeles, he sank a shaft instead of drilling a well—an outgrowth of his gold mining experience. He found oil and this marked the beginning of his connection with the industry.

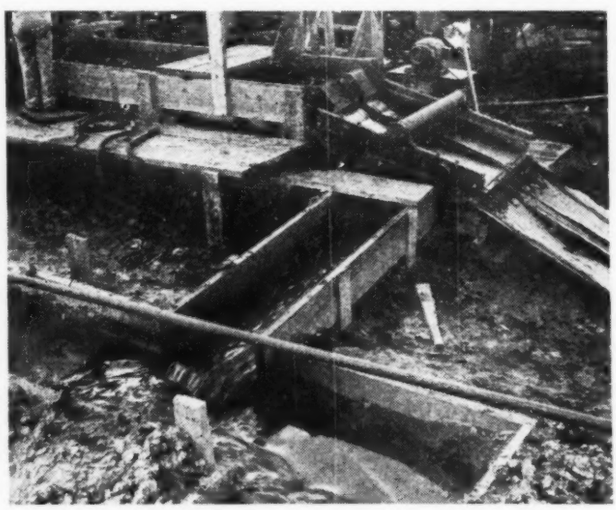
EDWARD L. DOHENY

In later years his oil holdings embraced California, New Mexico, Mexico, Peru, and British Guiana. It was Doheny who, in 1910, discovered the rich crude deposits near Tampico, Mexico. He also has the distinction of constructing the first pipe line in that country. The largest well in the Tampico field was drilled by Doheny, in 1916. It produced 260,000 bbl. per day until closed in, and an aggregate of more than 80 million barrels.

Later years found him active in California fields, in New Mexico, and South America. At the time of his death he was president of the Petroleum Securities Corporation.

Well Controlled with 16.8 lb. Mud

Recently a deep drilling well in the Gulf Coast threatened to blow out and Colox, because of its weight and high fluidity combined with its other desirable properties, was circulated in the well to keep it under control. The mud, shown in the illustration flowing through the screen and out of the trough, weighs 16.8 lb. per gal. and has a 22 sec. pour test of 500 cc. on a Morse type funnel viscosimeter with constant head. Even at this weight the mud is as pumpable as an ordinary mud having a weight of only 9 or 10 lb. per gallon.



Carl C. Joys, Jr., Made Vice-President A. O. Smith Corporation

The board of directors of A. O. Smith Corporation, Milwaukee, Wisconsin, through Rae F. Bell, executive vice-president, have announced the election of Carl C. Joys, Jr., to the office of vice-president of the corporation.

Joys has been connected with the A. O. Smith Corporation since August 1, 1924, as manager of sales, and later in the capacity of director of sales of the oil and gas products division and all other products aside from the automotive division, and has devoted his entire time to these lines. He will continue this work in his new position as vice-president.

Joys has been a director of the corporation since October, 1927.

F. P. Cox Retires as Plant Manager for GE; N. J. Darling Assumes Duties

With the retirement of F. P. Cox as manager of the West Lynn, Massachusetts, works of the General Electric Company on September 1, Nelson J. Darling, manager of the River Works of the company at Lynn, assumed management of both plants, it has been announced by Vice-President W. R. Burrows.

Cox has been associated with the General Electric Company 45 years. Darling in his new duties will have N. M. DuChemin, formerly superintendent of the West Lynn works, as assistant manager in charge of operations at West Lynn. W. G. Mitchell will continue as assistant manager in charge of operations at the River Works.

Wire Line Core Barrel

The Hunt wire line core barrel, manufactured and serviced by Authorized Appleman Bit Service Company, Houston, Texas, is now built in five types, for taking as many sizes of cores and meeting the various requirements existing in auxiliary equipment now in use.

The core cutter is integral with the bit. The barrel latches under a sleeve near the top of the drill collar and has no part in cutting the core.

On each side of the cutting member is an opening to permit cuttings being washed out in the circulation when a core is not being taken. When the barrel is dropped for a core and seats in the bit these openings are closed by the barrel, throwing full circulation through the bit water courses.

After the core has been taken the barrel is withdrawn through the drill stem by an overshot on the wire line. The latching arrangement, shown near the top of the barrel, is simplified to the point of latching the barrel securely in the drill collar during coring procedure. This latch immediately retracts, freeing hold on barrel, when overshot catches and raises it.

A Grizzly Powerflex Rotary Hose setup is known to have been used for drilling to completion six different wells ranging in depth to 7,500 feet and more.
Grizzly Powerflex performance is consistently spectacular in Kettleman Hills and other fields where the service is the toughest in the world. Ask some of the drillers in these fields about it.
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FLEXIBLE
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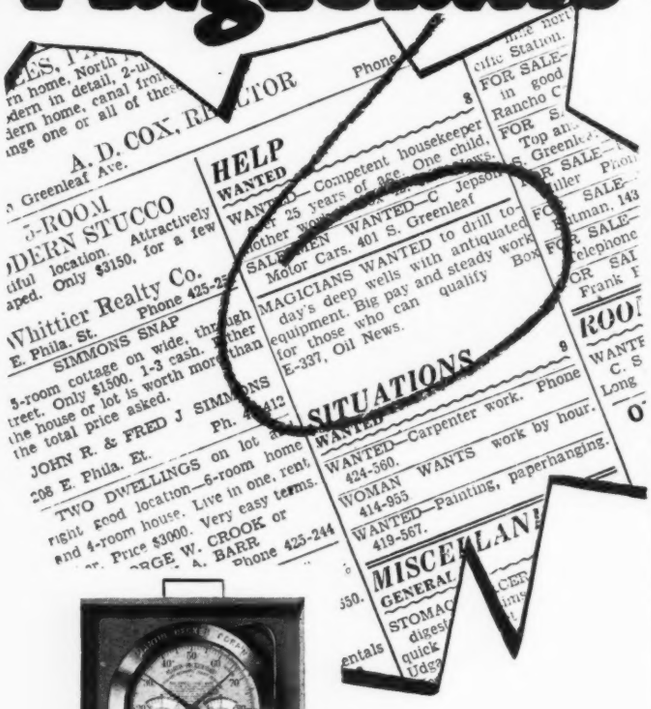
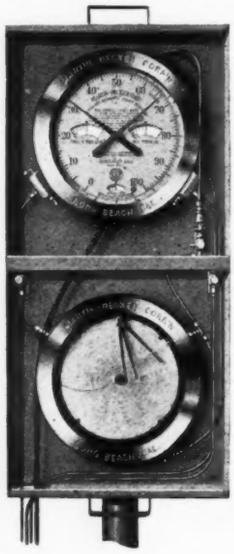
ARCH BOWMAN, Representative, KENNEDY BUILDING, TULSA, OKLAHOMA
T. T. WORD SUPPLY CO., INC., HOUSTON, TEXAS — In All Their Stores

Wanted.. Magicians





Most of us are not magicians, consequently we need modern, up-to-date equipment to drill today's deep wells. The "Quintuplex" takes all the guess out of drilling. It enables the driller to note every action, every change, every condition as it actually occurs during drilling progress. Call the nearest Martin-Decker representative and have him tell you how easy it is to change over to "Quintuplex" — the modern drilling control instrument.

THE WEIGHT INDICATOR
MARTIN DECKER CORP.
LONG BEACH CALIFORNIA

San Joaquin Valley: A. F. McQUISTON, Oildale, California

Mid-Continent Distributor: REED ROLLER BIT COMPANY, Houston, Tex.

Harry C. Morehouse on Trip to South America

HARRY C. MOREHOUSE

Harry C. Morehouse, vice president and sales manager of the Machinery Division, Emsco Derrick and Equipment Company, with headquarters at Los Angeles, California, left recently on an extended journey to South America that will include practically all the important oil fields of the southern republic.

While there he will make a personal survey of the South American fields, as well as contacting the various Emsco distributing outlets in that territory, for the purpose of providing oil companies with service facilities that will adequately meet all requirements of future operations.

Morehouse has been with the Emsco organization for many years and enjoys a wide acquaintance throughout the petroleum industry. The duration of his journey is rather indefinite, depending on the time required to accomplish the purpose in mind.

E. C. Delgarde Rocky Mountain Representative E. M. Smith Co.

E. M. Smith Company of Los Angeles, California, announces the appointment of E. C. Delgarde as representative in the Rocky Mountain district, with headquarters at Casper, Wyoming.

Delgarde is well known throughout the petroleum industry, having been connected with the Chicago Pneumatic Tool Company in similar capacity for a number of years.

The E. M. Smith Company are manufacturers of a number of products used throughout the oil fields of the world, among others Grizzly "35" Brake Blocks, Grizzly XT Lagging, Grizzly Drill Pipe Protectors, Grizzly Powerflex Rotary Hose, Grizzly Cub Rotary Hose, Grizzly Rotary Hose Couplings, and various types of belting and mechanical rubber goods.

John W. Carpenter Joins Staff Republic Steel

John W. Carpenter, for 16 years district sales manager in the Cleveland, Ohio, territory for the Otis Steel Company, has joined the organization of Republic Steel Corporation as assistant manager of sales, sheet and strip division, according to announcement by N. J. Clarke, vice-president in charge of sales for Republic. Carpenter's connection with Republic at its Youngstown, Ohio, headquarters took effect September 1.

Carpenter, a graduate of Princeton University, served as first lieutenant in the U. S. Army during the World War and entered the steel industry immediately afterwards. He brings to Republic a wide knowledge of the steel business with particular emphasis on flat rolled products.

A *Simple* AND *Efficient* MEANS OF CENTRAL PLANT OPERATION

The Kobe method is ideally adapted to producing a group of wells of approximately the same fluid level from a central power plant, and its application in this type of service is practically unlimited.

Accurate records of Kobe central plant operation show the same comparative advantages and economies as individual well installations, and the same improvement over other methods in volumetric and over-all field efficiencies.

These records will prove tremendously interesting to producers having groups of wells adapted to this method of operation. Detailed data will be supplied to any oil company executive on request.

KOBE, INCORPORATED
(Pronounced Kō-bē)

. . . Manufacturers of KOBE Heat-Treated Screen Casing and KOBE Pumper . . .

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Write for Bulletin No. 34-100 illustrating and describing the Kobe Pump and Kobe hydraulic method of pumping.

KOBE HYDRAULIC DEEP WELL PUMP

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3 cone

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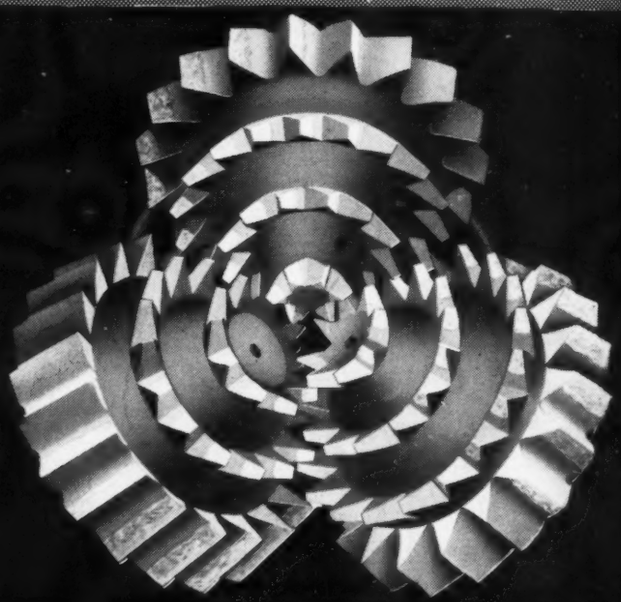

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HOUSTON,
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